



KEEP AMERICA
BEAUTIFUL
— K A B . O R G —



WASTE IN PLACE LEADER SERVICE AND PROJECT-BASED LEARNING

2018



Leader Guide PDFs

LEADER GUIDE

Leader Overview

Service Learning

- ▶ Benefits of Service Learning
- ▶ Effective Service Learning

Professional Development

- ▶ How to get Professional Development Hours from KAB

Background

- ▶ A conversation on Conservation
- ▶ Composting
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Fast 5

- ▶ Composting
- ▶ Garbage Basics
- ▶ Landfills
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TIP for using this document in Adobe Acrobat:

To return to the previously viewed page use the combination Alt and the left arrow on your PC or command-left arrow on a MAC.

In Preview (the default PDF reader on Macs), use Command-[(open square bracket).

LESSONS

Litter

- ▶ Cache & Trash
- ▶ Litter Evaluation
- ▶ Why Adopt a Highway

Community Greening and Beautification

- ▶ The Recycled Garden
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Waste Management

- ▶ Advertise our Attitudes
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Recycling

- ▶ Can This Last Forever
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Personal Responsibility

- ▶ Over the Rainbow

APPS Library

Fast5 Video Links



LEADER GUIDE



About Keep America Beautiful



Keep America Beautiful is the leading national nonprofit that envisions a country where every community is a clean, green and beautiful place to live. With our powerful network of community-based affiliates, we work with millions of volunteers who take action in their communities to transform public spaces into beautiful places.

Education and behavior change are the cornerstones of our organization. Our work educates and empowers generations of environmental stewards. We provide the right tools and resources to guide people's understanding and actions to keep our nation's communities clean, green and beautiful.

Whether the place is a community garden, a city park or a vacant lot, public places provide a neutral space in which people can come together with a shared purpose of community building. By continually improving public spaces while caring for neglected ones, positive social and economic change occurs in communities across the country.

Through our programs and public-private partnerships, we engage individuals to take greater responsibility for improving their community's environment. Our service projects are based on the knowledge and needs of the communities where we operate.

We work closely with governors, mayors and other local government and community leaders including state affiliates and state recycling organizations to ensure that we're meeting the needs of local communities.

Through our actions and impact, we help create communities that are socially connected, environmentally healthy and economically sound.

Our education programs empower generations of environmental stewards

Our formal and informal education programs empower generations of environmental stewards, teaching individual responsibility toward one's environment.

We promote environmental literacy that creates a culture in which understanding, knowledge and experience motivates individuals to improve their community's environment. We believe that individuals need to be aware of environmental issues in order to adopt appropriate attitudes and develop the necessary problem-solving skills to take action in their communities. Collective action is critical to achieving behavior change and improving environmental literacy across communities.

From building vegetable gardens and protecting community watersheds to removing litter from roadsides and educating children about recycling, we provide the opportunities to guide people's understanding and actions to:

Reduce waste

Increase recycling

Protect the natural areas of our communities

Ensure beauty is the lasting signature

At Keep America Beautiful, we believe that one single, purposeful decision to do things *differently*, and more *responsibly*, can make a significant difference. As the nation's leading nonprofit that builds and sustains vibrant communities, we engage millions of volunteers taking many small actions to bring about a world of change. It's our mission to engage individuals to take greater responsibility for their community's environment.



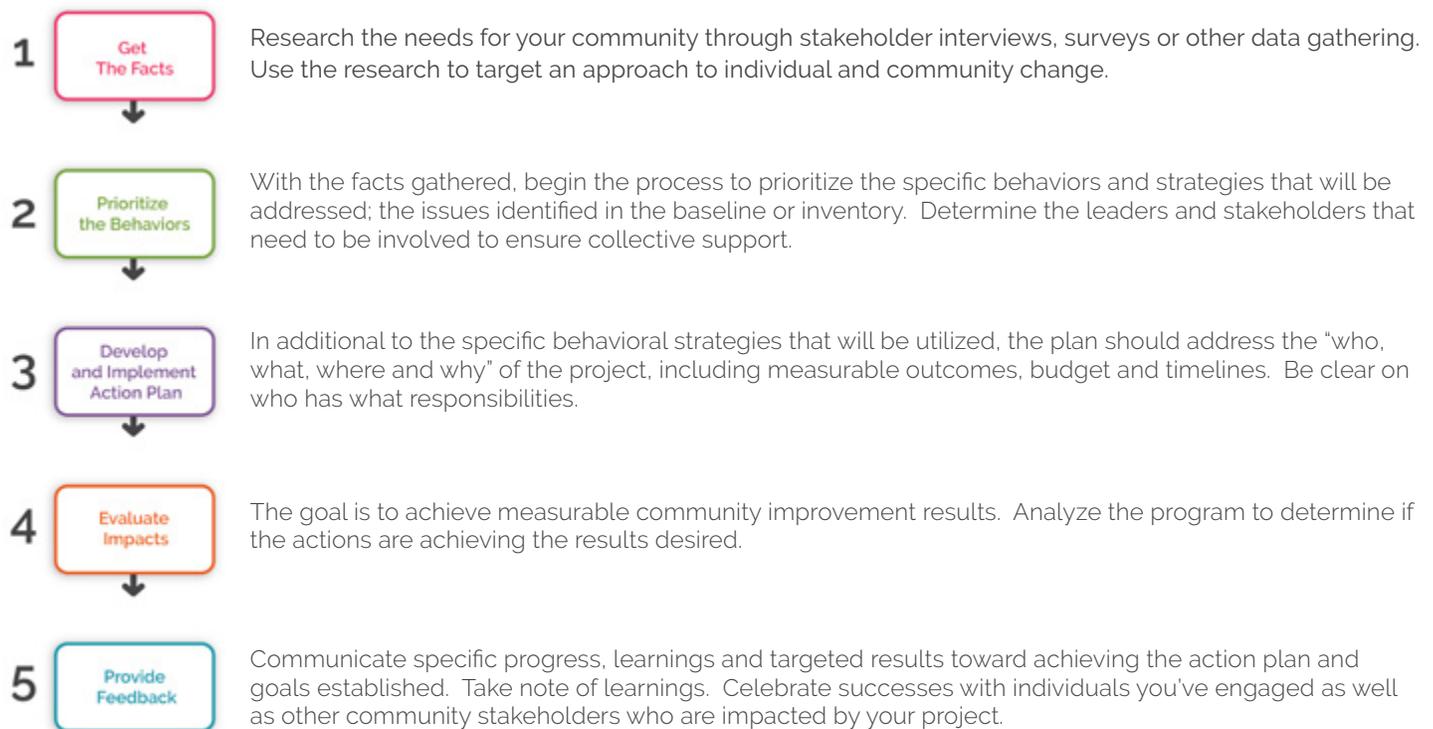
Attitude and Behavior Change Process

For 40 years, Keep America Beautiful (KAB) has successfully applied a proven behavioral approach to reducing littering and increasing community greening, waste reduction and recycling.

Our Attitude and Behavior Change Process was developed through research and field-testing by a team of behavioral scientists led by Dr. Robert F. Allen of the Human Resources Institute. This team recorded that behavior change is the only effective way to achieve lasting sustainable improvement in a community's quality of life. In 2016 KAB convened an Advisory Council made up of five behavioral scientists to review and revise the process. KAB and our affiliates develop and execute programs utilizing this integrated approach - the five-step management process and the Four Behavior Change Strategies.

5 Step Management Process

The process is a cornerstone of Keep America Beautiful. The five-step management process is embedded in all that we do to drive positive change, and should assist you in individualizing a KAB national event to reflect your interests and the needs that you identify within your community. The process includes:



Behavior Change Strategies

Changing the behaviors that generate litter and other community blight is the long-term solution. Changing attitudes and influencing behavior are brought about most effectively using a combination of methods. Use the strategies below to help develop projects that will change individual behavior and, ultimately, your community.



- ▶ **Written Expectations.** What are the written expectations that are designed to guide behavior? How might those be changed -- such as public policy through codes, laws or ordinances to change behaviors around quality of life and environmental issues.
- ▶ **Rewards and Penalties.** What are the consequences, positive or negative for behaviors? Rewards and recognition as well as consistent and effective enforcement of existing policy, codes etc. help change behavior and reinforces the commitment to a cleaner, greener community.
- ▶ **Infrastructure.** What are the resources and technologies needed to support behavior change? This can be tools such as a litter pick-up tool or other infrastructure changes such as providing recycling bins to support making different long-term choices.
- ▶ **Persuasion.** What methods will be used to educate and persuade others about this change and how they can support it? Social marketing concepts include: communication, commitment, prompts and social norms for example.

Using this guidebook can help promote youth-led action for change with individuals joining together with Keep America Beautiful and our network of affiliates in KAB-sponsored national events, or through the creation of service projects that reflect the unique needs of an individual's community.

Keep America Beautiful COMMUNITY SERVICE LEARNING

Keep America Beautiful Community Service Learning Opportunities

Great American Cleanup: March 1 through May 31

America Recycles Day: On and around November 15

Community Greening: Fall/Spring

Introducing youth to Community Service Learning

Introduce your youth to the idea of the power of individuals working together to improve their communities using the KAB Youth Advisory Board members profiles as examples (<https://www.kab.org/our-programs/education/youth-advisory-council>). Use the KAB lesson [Over the Rainbow](http://www.kab.org/our-programs/education); a First Look at vision for change (<http://www.kab.org/our-programs/education>) to help youth identify and organize needs within their community and a vision for the future.

Introduce youth to the Youth Guide

(<https://www.kab.org/our-programs/education/student-and-leader-learning-guides>)

Selecting a KAB Event or creating your Own

After completing the visioning exercise [Over the Rainbow](#), have youth complete the When, What, Where and Who sections of the guide.

Evaluate

Before moving to the Overview section of the chosen KAB program have youth complete the appropriate pre-test.

All program pre-tests are located here (<https://www.surveymonkey.com/s/KABYOUTHPRE>), youth will be guided to the appropriate questions.

Professional Development Opportunities

[How to Get Professional Development Hours from KAB](#)

[Selected Readings](#)

[Journaling Activity Survey Monkey](#)

Getting Started/Selecting Your Project

Great American Cleanup	America Recycles Day	Community Greening	Self-Designed
Focus: Litter Prevention, Education, and Awareness	Focus: Recycling Awareness	Focus: Community Greening	Focus:
Time: March 1-May 31	Time: November 15	Time: Fall or Spring	Time:

When?

The KAB project in which your school participates may be determined by the time of year.

When do you want to do a project?

Which projects fit that time of year?

What?

What project interests you the most? _____

Does the project that interests you fit your time-period? _____. If so, you have selected your project!

Which project did you select? _____

If your interests and time-period do not match, please select a project that meets your time-period. We will explore ways to incorporate your interests into this project later.

What is your goal? _____

Where?

Often a specific place or area especially needs the benefits of your project. Can you list a few for your group to consider?

Who?

Who will this project benefit? _____

Who or which organizations have missions that share your project goal? _____

Use the list to identify sources. Who can help with volunteers? Who can help with project funding or materials?

How?

The Five-Step KAB Attitude Change System will organize your planning and Keep America Beautiful will direct you to a multitude of resources for you project. Let's get started!

GREAT AMERICAN CLEANUP

Engaging Youth

Articles

[Scripps Institute of Oceanography: Inside the Plastic Vortex \(intro to youth for litter or recycling\)](#)

Videos

[Scripps Institute of Oceanography](#)

[Ocean Adventure Video: Trash on the Spin Cycle; Jean-Michel Cousteau](#)

Games

[Kure Waste Chase interactive game](#)

KAB Lessons

[Litter Evaluation Bag](#) activity; use to open discussion about litter, kinds of litter and personal and cultural views of litter.

[Advertise Our Attitudes](#); designing an advertising campaign to put a voice to an issue.

Partner Lessons

[Why Adopt a Highway](#) from the Council for Economic Education

Apps

[Unit Converter](#) Android, [Unit Converter](#) iPad

More

[KAB Great American Cleanup Registration login](#)

[KAB Great American Cleanup Downloadable Materials and Resources](#)

[GAC Youth Post-test](#)

[Leader/Teacher reflection form Link](#)

Keep America Beautiful National Events Overview

Great American Cleanup

The [Great American Cleanup](#), the country's largest community improvement program, serves as a platform for a wide range of initiatives including cleanups, litter prevention education, recycling drives, graffiti removal, community greening projects, park renewals, clothes collection programs, river, lake and seashore cleanups, and more.

When one is seeking to make a visible community impact, litter is certainly a place to begin.

Why?

While visible roadside litter has decreased by about 40 percent since 1969 litter, or misplaced solid waste, is still a persistent problem. Consider these facts*:

More than 51 billion pieces of litter land on U.S. roadways each year. That's 6,729 items per mile. Litter cleanup costs the U.S. almost \$11.5 billion annually, with businesses picking up \$9.1 billion of that tab. The presence of litter in a community takes a toll on quality of life, property values, and housing prices.

Why do people litter?

- ▶ **Personal Choice.** Litter is primarily the result of individual behaviors. Nearly one in five, or 17 percent, of all disposals observed in public spaces were littered. The remainder (83 percent) was properly discarded in a trash or recycling receptacle. Most littering behavior – 81 percent—occurred with notable intent.
- ▶ **Litter Begets Litter.** Individuals are much more likely to litter into a littered environment. And once there, it attracts more litter. By contrast, a clean community discourages littering and improves overall community quality of life. Availability and proximity to trash and recycling receptacles also impact whether someone chooses to litter.
- ▶ **It's Not My Responsibility.** Some people feel no sense of ownership for parks, beaches, and other public areas. They believe someone else will pick up after them. Community cleanup and beautification projects that engage local residents can help foster a sense of ownership for public spaces.

Keep America Beautiful encourages Great American Cleanup coordinators to incorporate a variety of community improvement activities during the GAC. A litter pick-up is simply one of many potential GAC initiatives. It is up to each coordinator to go through the KAB Five-Step Attitude Change System to determine and implement projects that best address your local needs.

**Keep America Beautiful 2009 "Litter in America" Study*

America Recycles Day

Engaging your Youth

Article

[Why Recycle \(Article with Interactive elements\)](#) login - cboyette@kab.org, password - recycle1010

On left side of screen explore Toxic Computer, Test your e-cycling IQ, and excellent Photo Gallery!

Video

[Landfill from FocusForward](#)

Games

[Android Recycling Classification](#)

KAB Lesson

[Earth the Apple of Our Eye](#) is a very visual approach to introducing the concept of Earth' finite resources.

[Can This Last Forever](#), Natural Resource Consumption a view of the effect of exponential function on consumption of natural resources

Partner Lessons

[The Economics of Recycling](#) from the Council for Economic Education

Apps

Android: [Carbon Footprint Calculator](#), [Price & Selling Recycle Electronics](#)

Apps iPad: [Composting \\$.99](#), [Where to Recycle](#)

More

[How to register guide](#)

[Login to report on KAB Dashboard](#)

[Toolkit/ Guides/Templates & Resources](#)

[ARD Post-test Link](#) Please have your youth complete the post-test evaluation before sending in your ARD report.

[Leader/Teacher reflection form Link](#)

[Take the Pledge to Recycle More](#)

America Recycles Day

[America Recycles Day](#), a program of Keep America Beautiful, is the only nationally recognized day and community-driven national awareness initiative dedicated to promoting and celebrating recycling in the United States. Since its inception in 1997, communities across the country have organized events for America Recycles Day on and around Nov. 15 to promote recycling awareness, commitment, and action. Last year, 2 million people celebrated recycling at more than 2,000 events across the nation on America Recycles Day.

Why Recycle?

- ▶ Recycling is the easiest thing we can do 365 days a year to save energy, conserve natural resources and create green jobs.
- ▶ Recycling is a multi-billion dollar industry that employs millions of Americans and helps advance our clean energy economy.
- ▶ The value lost by discarding packaging rather than recycling is estimated to be \$11.4 billion¹
- ▶ Recycling 75 percent of the nation's waste would create nearly 1.5 million jobs by 2030²

Our national recycling rate of 34 percent annually:

- ▶ Can save the energy equivalent of 165 gallons of gasoline for every ton of mixed paper³
- ▶ Avoids greenhouse gas emissions equivalent to removing more than 36 million cars from the road each year

[Recycling Fun Facts](#) (This link will automatically download a PDF to your computer)

America Recycles Day

One day to educate and motivate...One day to get our neighbors, friends and colleagues excited about what can be accomplished when we all work together...One day to make recycling bigger and better 365 days a year!

Do you have a great school recycling program or want to start one? Do you like competition? Check out the Keep America Beautiful Recycle-Bowl Competition @ <https://www.kab.org/recycle-bowl/>

1: As you Sow, "Unfinished Business: The Case for Extended Producer Responsibility for Post-Consumer Packaging", 1 10/12/12

2: Tell us Institute with Sound Resource Management, "More Jobs, Less Pollution: Growing the Recycling Economy in the U.S."

3: EPA, "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010", 9

Community Greening

Engaging your Youth

Article

Backyard Biodiversity (Why we need native plants)

<http://www.americanforests.org/magazine/article/backyard-biodiversity/>

Video

Invasive Species <http://www.cbsnews.com/video/watch/?id=7386464n>

Lessons

KAB Lesson: The Social Blast guides youth through developing a media campaign for their project

Partner Lessons: National Arbor Day Foundation; Discover What Trees Do For Your Community

Partner Lessons: Texas Forest Service Tree Trails

Apps

Android: Tree ID, Plant ID & Photo

Leaf Snap: [tree identification by photographing a leaf](#)

Better Homes & Gardens Plan A Garden: <http://www.bhg.com/gardening/design/nature-lovers/welcome-to-plan-a-garden/>

Get Growing from iPad calculates the savings of growing your own food with additional info on what and when to plant and harvest.

Google Search App–Google Goggles identify flowers, plants and even bugs with a snap of your phone camera or pad.

More

[CG Post-test](#): Please have your youth complete the post-test evaluation before uploading your project.

[Leader/Teacher reflection](#)

Community Greening

Community greening starts with getting involved. Each year, Keep America Beautiful involves millions of volunteers in beautification and community greening programs that have a positive impact in more than 20,000 communities.

Our affiliates and partners conduct efforts to plant native species; build sustainable community gardens, including fruit and vegetable gardens; plant thousands of trees and urban forests; and educate tomorrow's environmental stewards. Beautiful public places transcend aesthetic appeal to positively influence the social, environmental and economic lives of area residents, visitors, businesses, and institutions in our neighborhoods and towns.

Community greening also celebrates the value and power of native species in restoring ecological balance to the environment. Keep America Beautiful's strategic initiative is to increase native species plantings in communities. The initiative focuses on three areas of need: increasing native trees, shrubs and plants in public places; greening vacant lots with low-maintenance indigenous plants and trees in underserved neighborhoods; and bringing natural, sustainable beauty to enhance communities' green Infrastructure.

Whether you are celebrating national events like Make a Difference Day, Arbor Day, National Planting Day or a locally planned project, nonprofit Keep America Beautiful, its affiliates and its partners are ready to help Americans to plant native species of trees, flowers, and plants.

Why It Matters

Property values and rent rates: Planting a tree within 50 feet of a residence can increase its value by 9%

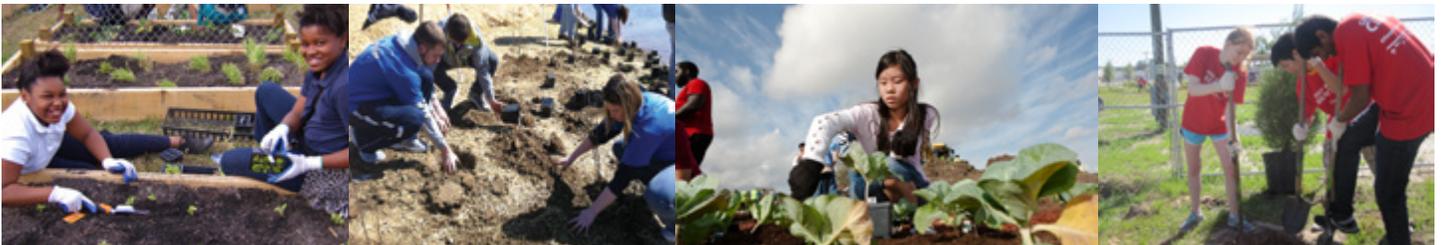
Commerce: Treescaped business districts average 12% higher revenue than treeless areas.

Safety: Beautification projects bring neighbors together, building pride, cohesion, and connection.

Health: Green public spaces encourage exercise.

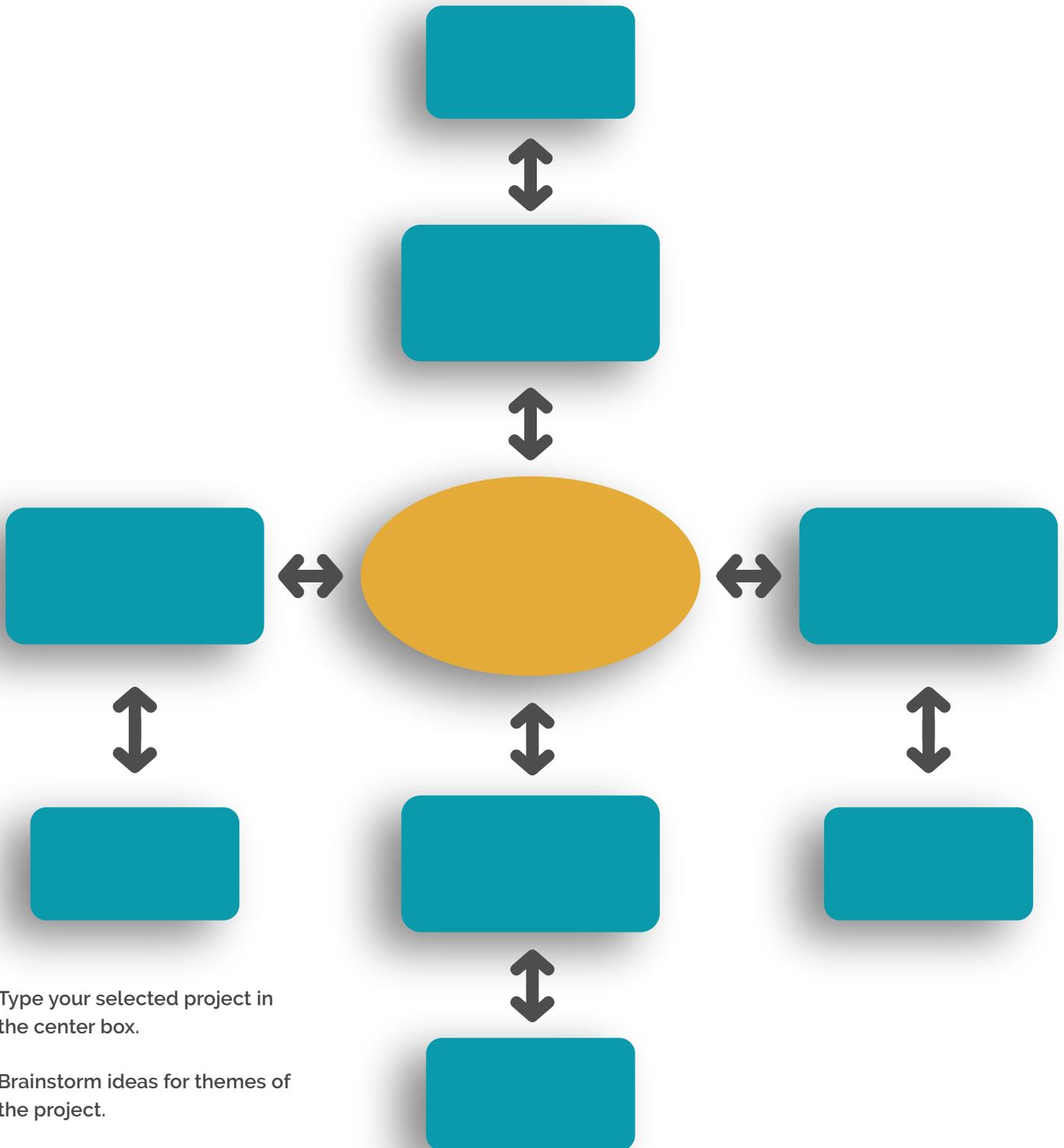
Infrastructure savings: Treescapes reduce soil erosion, decrease storm water runoff.

More: For a comprehensive look at the benefits of community greening, [click here!](#)



Creating Your Plan

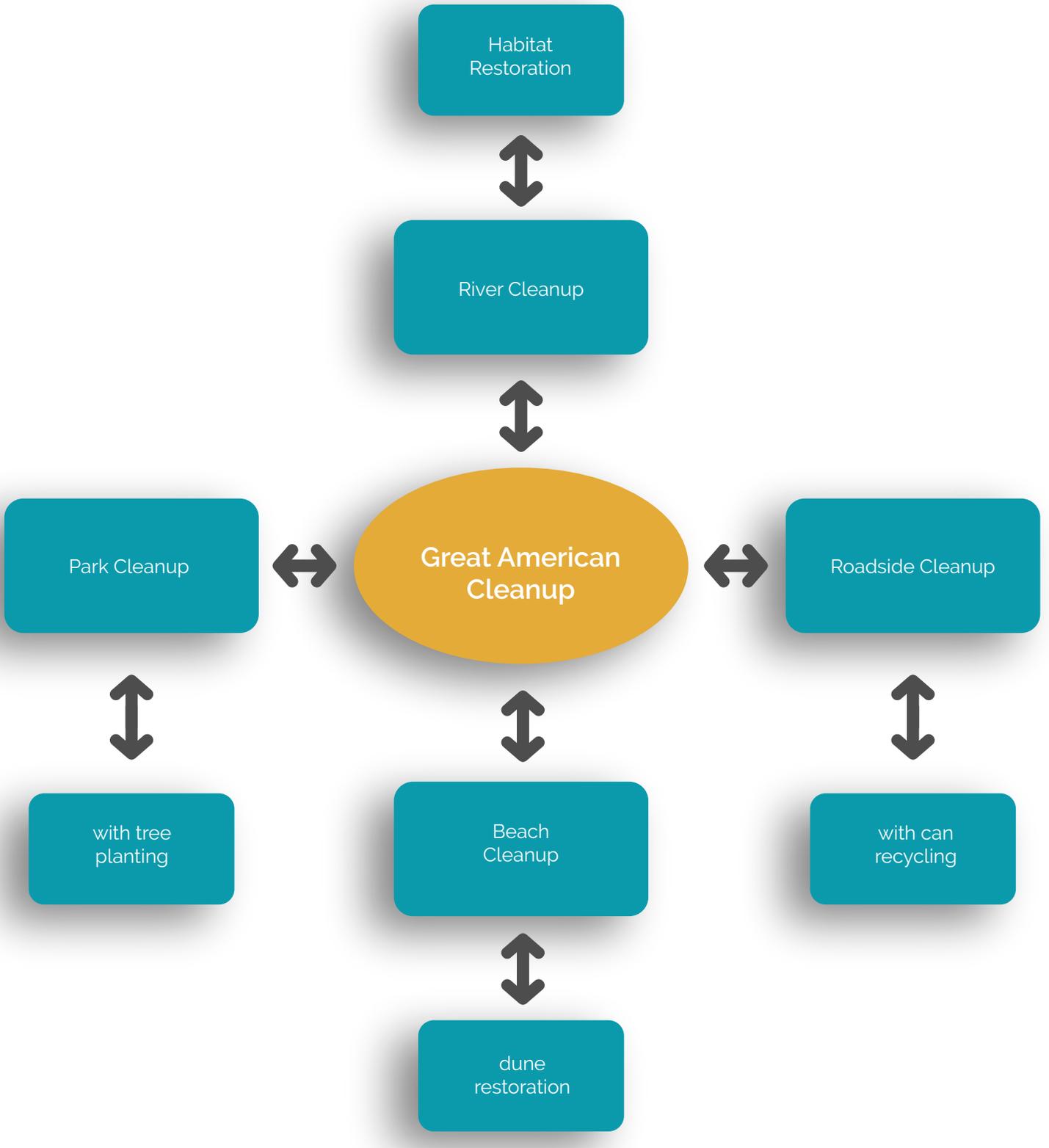
Use the graphic organized to organize your group's ideas about the direction your project will take.



Type your selected project in the center box.

Brainstorm ideas for themes of the project.

See example on the next page



Get the Facts

How does this issue affect you?

What are the costs to your community and society in general?

Health costs? _____

Financial costs? _____

Quality of life costs? _____

Environmental costs? _____

How will your project affect this issue?

Is this project important to you? Why, or why not?

Should it be important to others? Why?

Is this issue unique to your community?

What are others doing to address this issue?

Involve the People

Who will benefit from your project?

List everyone affected in a positive way by this project. Briefly tell how they will be impacted.

Are there any individuals, groups, organizations, businesses, or agencies that this project might affect in a negative way? Is there a way to prevent that from happening?

Partners

How many people do you need to accomplish your goal? What funds and/or materials do you need for your project? Make two lists; one is for individuals, groups, businesses, organizations, and agencies that share your vision or mission and could provide volunteers, and the second list is for sources of financial or material support.

Volunteer Sources

Financial/Material Support

Plan Systematically

The purpose of a project plan is to keep everyone on track and focused. This is a group project and everyone needs to contribute by using their natural gifts, talents and skills, and learning new ones.

Let's restate your project and list your goals so everyone is on the same track about what you are going to accomplish.

Be **SMART** when writing your objectives and goals.

Specific: Objectives should be specific (e.g., on April 15 we will host a litter cleanup in City park.)

Measurable: Check your progress in measurable terms (e.g., we will recruit 25 volunteers by March 15.)

Attainable: Don't over-extend your time and capabilities. Create success for everyone involved, and then grow larger!

Relevant: Be sure that your actions (measurable) support your project (e.g., obtaining a donation of 5 gallons of paint does not support a litter cleanup.)

Time: Don't take shortcuts; include ample time for planning, execution, and wrap-up.

Project

Objective

Start by Creating a Project Timeline

Enter the start date (this would be today,) enter your project event date and your wrap-up date (when you review the project and turn in all required reports). As you plan and assign tasks, add that information to the timeline including assignment date, person responsible and due date.

Start Date	Event Date	Wrap Date
January 15	April 15	May 15

Mission	Who is assigned to this task	Who is the team leader	Completion date	Mission Priority Level
What is the job that needs done?	List of team members.	Who will coordinate this work?	When do you need it completed?	Some jobs are essential to successful completion of a project (1,) some are needed but have some flexibility (2) and a few are not essential but are add-ons to the main project(3.)

Use the table to create and assign tasks for the project, then add them to the Project Timeline. (Add more rows by right clicking in the bottom row and select add row below or above.)

What We Need

Make a list of all the things needed for successful completion of your project. Some common project needs include— transportation, advertising, materials, supplies, tools, protective gear (gloves, vests,) drinking water (think about getting reusable bottles or ask volunteers to bring one), items for an after-event celebration such as food or awards. Add to Timeline.

Item Needed	Quantity Needed	Mission Team Leader	Cost of Item	Donated By	Cash Donation By	Additional Support needed

You Will find blank fillable verions of these forms on pages 14 and 15.

Volunteers

Earlier you listed potential partners. Let's find ways to tell them about your project and recruit them.

Make a list of ideas for ways to contact the people you want to recruit. Take the list of the people, groups, organizations, and agencies you want to recruit. What is the best way to get your message to these potential partners? No one way is best for everyone, so let's explore some possibilities and get a team working on creating your project advertising campaign.

Type of contact	Who will create*	Materials or info needed
Personal Contact		A standard description of the project, who to contact, what, when, where, why, how to volunteer/contact
Email blast		Email list & message from above
Social Media		
Newspaper		
Radio PSA		
Posters/Flyers		
What other ways?		

KAB has great resources for your campaign! [GAC](#), [ARD](#)

Now Match the Type of Contact to the Type of Volunteer

Remember when recruiting to include those individual with any special skills required to complete your project. For example, a Master Gardener or Landscape Designer would be important if you plan to do a community beautification project.

Volunteer	Contact Method	Person Making Contact	Date Contacted	Response*	Confirmation/reminder Contact Date
Ex. Sally Jones	Phone call	Mary Williams	1-6	Bring Family of 4	4-10
XXX Fraternity	Email Blast	Bob Smith	1-7	14 members	4-10
General Public	Newspaper	J. Long	2-15	4 responses	4-10

Be sure to create an information card on each volunteer or group of volunteers so you can confirm/remind them about the event the week before the event, and thank them after the event!

You will find blank fillable versions of these forms on page 26.

Volunteer Forms

Type of contact	Who will create*	Materials or info needed

Volunteer	Contact Method	Person Making Contact	Date Contacted	Response*	Confirmation/reminder Contact Date
Ex. Sally Jones	Phone call	Mary Williams	1-6	Bring Family of 4	4-10

Guiding Your Project to Completion

Some things to remember along the way:

Remember WHY you are doing this project and how it will help your community.

Remember you are NOT alone, this is a team effort.

Remember this is a learning experience for EVERYONE, ask for help when you need it, offer it to others that you see struggling.

Focus on Results

Check your timeline daily. Keep it updated.

Post photos Twitter and Instagram throughout your project with hash tags such as #KeepAmericaBeautiful.

Complete the Keep America Beautiful reports if you registered for any KAB programs, and review the results with your team. Review your project goals. How did you do?

As a group, make the following lists:

What new skills did you learn?

What new things did you learn about your project issue?

What new things did you learn about your community?

Did you discover a new interest or possible career interest while working on the project?

What would you do differently if you did this project again?

Would you do this project again? Why or why not?

Send out the results to everyone including media sources! Include before and after photos.

Provide Positive Reinforcement

Have a celebration! Simple or extravagant...that is up to you. Celebrate with your team and volunteers. Highlight accomplishments. Give recognition in some form to everyone. Write thank you notes and give certificates of thanks for support. Include links to KAB hash tags and Instagram and the KAB Youth project site so volunteers can see your postings. Start planning your next KAB project. Submit for a [KAB Award!](#)



Service Learning

Benefits of Service-Learning from the National Service-Learning Clearinghouse

The National Service-Learning Clearinghouse (NSLC) is funded by the Corporation for National and Community Service, a federal agency mandated to help Americans improve the lives of their fellow citizens through service. "Benefits to youth who participate in high-quality community-based service-learning are likely to benefit in a number of ways (Chung, 1997; Coe-Regan et al, in press; Lewis-Charp et al., 2003; Tannenbaum, S. C., 2007; and YMCA of the USA, 2004):

- ▶ Young people gain access to the range of supports and opportunities (or developmental assets) they need to grow up healthy, caring, and responsible. One study of youth civic activism found that these settings had particular strength in cultivating youth and community involvement (Lewis-Charp et al., 2003).
- ▶ Increased sense of self-efficacy as young people learn that they can impact real social challenges, problems, and needs.
- ▶ Higher academic achievement and interest in furthering their education.
- ▶ Enhanced problem-solving skills, ability to work in teams, and planning abilities.
- ▶ Enhanced civic engagement attitudes, skills and behaviors. Many leaders in public service today speak about how they were nurtured, inspired, and shaped in early experiences in community service or volunteering.

Chung, A. N. (1997). [Service as a strategy in out-of-school time: A how-to manual](#). Washington, DC: Corporation for National Service. Retrieved from <https://gsn.nylc.org/home>

Coe-Regan, J. R., & O'Donnell, J. (2006). Best practices for integrating technology and service learning in a youth development program. *Journal of Evidence-Based Social Work*, 3, 201-220.

Lewis-Charp, H., HanhCao Yu, H., Soukamneuth, S., & Lacoce, J. (2003). [Extending the reach of youth development through civic activism: Research results from the youth leadership for development initiative](#). Takoma Park, MD: Innovation Center for Community and Youth Development.

Tannenbaum, S. C. (2007). Tandem pedagogy: Embedding service-learning into an after-school program. *Journal of Experiential Education*, 29(2), 111-125.

YMCA of the USA. (2004). *The YMCA service-learning guide: A tool for enriching the member, the participant, the YMCA, and the community* (2nd ed.). Chicago, IL: Author.

Effective Service-Learning

Core Elements of Practice

The Keep America Beautiful (KAB) Service-Learning Guide integrates the core elements of high quality service-learning experiences. The core elements were identified by RMC Research, 2007 to adhere to the following themes:

- ▶ Young people have active and meaningful leadership roles; the KAB service-learning program "Keep America Beautiful Youth Guide" is designed to be youth-driven and facilitated by a trained youth leader or sponsoring adult;
- ▶ The program is guided by clear and intentional learning and development goals;
- ▶ Active, intentional, and structured reflection is integral to the program. Journaling, self- evaluation and reflection are essential elements of the "Program";
- ▶ Young people are involved across time (at least 20 hours across several months);
- ▶ The KAB Program easily meets time requirements through individual research, cooperative planning, execution and reflection; and
- ▶ The service projects meet real community needs and priorities. The KAB program begins with a visioning exercise to identify community needs, student interests, group priorities and limitations.

The KAB "Program" is closely aligned with the factors identified by the National Research Council and Institute of Medicine (2002) as effective youth development practices that facilitate positive youth development:

- ▶ Physical and psychological safety;
- ▶ Appropriate structure;
- ▶ Opportunities to belong;
- ▶ Positive social norms;
- ▶ Support for efficacy and mentoring;
- ▶ Opportunities for skill building; and
- ▶ Integration of family, school, and community efforts.

Links to research used: <https://gsn.nylc.org/clearinghouse/results?key=benefits&type=&attrs=1>



Professional Development

How to Get Professional Development Hours from Keep America Beautiful

To receive a professional development certificate for six (6) hours from Keep America Beautiful (KAB) complete the following 10 simple steps!

- ▶ Introduce your students to the KAB [Over the Rainbow](#) visioning lesson; Youth guide and complete the **When?** And **What?** Section;
- ▶ With your students select a Keep America Beautiful event/program;
- ▶ Read at least one (1) of the selected readings;
- ▶ Have your students take the KAB Youth Survey/pre-test;
- ▶ Watch the "Teacher" mini-webinar for the program that you have selected;
- ▶ Complete at least one (1) KAB lesson;
- ▶ Complete the event/program with the students using the Leader & Youth Guides;
- ▶ File all KAB event/program registration and reports;
- ▶ Have students complete the KAB Youth Post Survey/post-test;
- ▶ Complete the Teacher/Leader Survey Monkey reflection and journaling activity and print your KAB professional development certificate.





Background; Covering the Basics

A Conversation on Conservation

New York City. The mid-eighteenth century. A young man from a privileged family steps quickly out of his front door, late to meet with friends down the block. His first step makes a splashing sound, and he looks down in dismay to see what caused it. He is immediately thankful because he has narrowly missed stepping in the contents of a recently emptied chamber pot. The young man plugs his nose and makes his way to the middle of the street. He has forgotten his umbrella, and cannot afford to be a mess by the time he reaches his friends. As he hurries down the street, he is barely aware of the rats, chickens, and cattle that graze and scavenge for breakfast among the trash lining the streets; this is ordinary. However, he pays close attention to the growling dogs and rooting pigs, which will aggressively defend their spoils if approached.

This was typically how waste management was practiced in early American cities.

Prior to industrialization, the households of American cities worked as closed systems— reusing, repurposing, and recycling resources. Americans burned most “left over” material after its intended use—either for heat or for cooking. In a typical American home, however, there was very little left over in the first place. Throughout history, America’s children have played an important role in our cities’ waste management. Children worked as “rag pickers,” sorting through trash for anything that could be used, sold, or eaten. Young girls, called “Little Cinderellas,” sifted through discarded ash for small discarded pieces of coal that their families then used for heating and cooking. “Swill Children” collected kitchen waste (or swill) from urban homes to sell to farmers as hog food and fertilizer.

Some items collected and how they were recycled

Item Collected	Item Made
Fat/Grease	Candles, Soap
Rags	Paper
Woolen Rags	Shoddy, Remanufactured Cloth
Metals	Melted –New Products
Bones	Buttons, Glue, Fertilizer

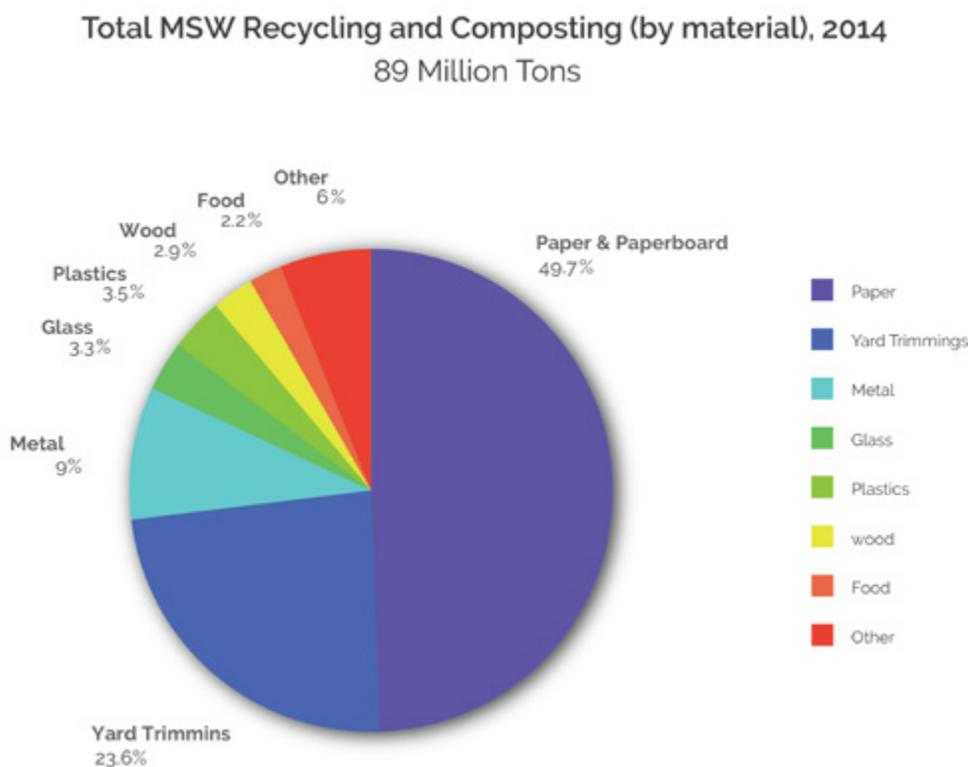
Residents of rural homes, much like the urban dwellers of the time, were ardent recyclers. Items not recycled in the home became currency, traded for goods with traveling peddlers. These peddlers served as middlemen, trading wares such as tin goods for rags, then selling the rags to paper companies in larger cities.

Early Americans generated very little waste, but what existed most often found its way into streets, alleyways, and yards. This waste—combined with human and animal excrement –created squalor that led to devastating epidemics of disease. At the dawn of the Industrial Revolution, the crises accelerated as city populations grew rapidly, causing overcrowding and repeated outbreaks of contagious diseases. Citizen groups compelled cities to take responsibility for garbage collection and disposal. Early methods of disposal included: dumping into rivers/oceans, open pit landfills, trash burning, and a reduction process called *stewing*. This process cooked wet garbage in large vats, and the resulting product became ingredients in fertilizer or in soap making. While the streets were indeed much cleaner, each of these methods created brand new problems.

By the early 1900s, America was rapidly changing. Where we once considered a product's remains as an item to be repurposed or recycled (through trade) back to the producer, we now considered waste as a "one-way exchange." Mass production and mass marketing contributed to an increase in product availability. New production methods eliminated the need for rags in paper production; wood became a plentiful and renewable source. With cheap paper products came an era of disposable cups, plates, and packaging of all kinds. As new materials developed, so did new waste problems—including chemical and hazardous waste.

As we continue to change, grow and consume, waste managers continue to develop new and better ways to manage our trash. As a society—and as individuals—the decisions we make about the products we purchase, and the actions we take for disposal, affect the economy, as well as the health of our communities and our planet. There is no "best management practice" for all communities; each one is different. A choice made today may not be the best choice in the future. As communities change, so do the economic and environmental options for managing the community's waste. The EPA report, *Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2014*, tells a story of our progress. As a percentage of total MSW generation, recovery for recycling (including composting) did not exceed 15 percent until 1990. Growth in the recovery rate to current levels (34.7 percent) reflects an increase in infrastructure and market demand for recovery over the last decade.

Figure 1



In the days before America's Industrial Revolution, consumers, suppliers/retailers, and manufacturers worked together in a closed system of production and supply. The EPA is working to improve on that idea, with Sustainable Materials Management (SMM). SMM builds on the concepts of *Reduce, Reuse, Recycle* in order to develop a systematic approach to reducing material use and environmental impacts over the entire lifecycle of a material or product. This approach begins with the raw material extraction and processing, product design and manufacturing, followed by collection/recovery and processing, to the final disposal at the end of the product's life. Through the study of material use in this manner, the EPA seeks to use less raw material and fewer toxic chemicals, thereby reducing the environmental impact across the lifecycle of the material.

Composting

Nearly half (23) of all of the states in the U.S. now ban yard waste from landfills because it represents such a large volume of waste and because it can be productively composted. There are about 3,400 community and commercial composting operations nationwide, according to the U.S. Composting Council.

When organic waste is disposed of in the trash, it ends up in a landfill with non-organic trash. As the landfill reaches capacity, it is covered; no air passes through it, causing anaerobic conditions. In these conditions, decomposition of organic waste produces methane within the landfill that needs to be released to relieve the buildup of pressure. The best way to decrease methane is to compost. The aerobic nature of composting produces very little methane.

What is Composting?

Composting is the aerobic, biological decomposition of organic materials. Living microbes combine with oxygen to cause this breakdown. The result is a nutrient-rich, soil-additive called "compost." Composting is true closed-loop recycling as it returns organic materials back to the earth.

What is Compostable?

Nearly all organic byproducts, including food scraps, leaves, grass, yard clippings, non-recyclable paper (paper towels, napkins, etc.), sawdust, and other wood products are compostable. Yard trimmings and food residuals are the most commonly composted items.

Methods of Composting [Cedar Grove Composting Video](#)

Composting can be as simple as a backyard pile or large outdoor sites with windrows, where organic matter, piled in long rows, is usually turned or aerated throughout the composting process. There are also more high-tech and controlled processes, such as in-vessel composting. Composting varies as well in the types of organic materials that are processed. Here are several approaches:

Grasscycling is a form of source reduction that involves the natural recycling of grass clippings by leaving them on the lawn after mowing. Community "Leave it on the Lawn" campaigns help keep grass and other organics out of the landfill.

Backyard Composting allows residents to compost yard trimmings and certain other organic materials in small composting bins or a simple pile in their backyards. Finished compost is then available for lawns and landscaping or in the home garden.

Vermicomposting uses red wiggler earthworms to process food scraps and other organics into worm casting. The worms eat over half their body weight each day. Composting using worms most often occurs indoors on a small-scale, but there are some larger vermicomposting facilities.

Yard Trimmings Composting is the large-scale processing of green organics, diverting one of the largest portions of the municipal solid waste stream from landfills and into a marketable product. Yard trimmings can include grass and leaves, tree limbs, trunks and brush, and garden materials. These can be brought to drop-off sites or picked up at the curb and sent to municipal composting facilities.

Source-Separated Organics Composting Programs rely on residents, businesses, and public and private institutions to separate one or more types of organic materials. This type of compost is usually green wastes, food, and soiled paper, and they are set out for collection separated from other recyclables and trash.

Mixed Municipal Solid Waste Composting is the collection of organics commingled with other materials. In this approach, sorting removes recyclables, hazardous, and non-compostable materials from mixed MSW. Composting awaits the remaining organic materials. The downside to this approach is the potential for contamination.

What is compost?

Compost is what results from the aerobic decomposition of organic matter, or composting. Also known as humus, compost is considered a soil conditioner rather than a fertilizer. It provides valuable organic matter to the soil, improves soil structure, aids in microbial activity, attracts beneficial insects like earthworms, can suppress soil-borne diseases, and releases nutrients slowly, allowing for availability throughout the growing season.

Benefits of Compost

Using compost has important environmental benefits:

Enriches the soil, reducing the need for water, fertilizers, and pesticides.

Helps clean up or remediate contaminated soils.

Prevents pollution. Diverting organics from the waste stream ultimately avoids the production of methane and leachate in the landfills. Compost can also help stop pollutants in storm water runoff from reaching surface water resources.

Prevents soil erosion and silting on embankments parallel to creeks, lakes, and rivers, and prevents erosion and turf loss on roadsides, hillsides, playing fields, and golf courses.

Using Compost

Finished compost is widely used in agriculture and horticulture (gardening), landscaping, golf course construction and highway beautification, and as a landfill cap (the layer of soil that is placed over old landfills after they have reached capacity). Public agencies also use compost in the remediation of contaminated soils, to prevent soil erosion, and in storm water management. Communities employ compost at parks, recreational areas, and other public properties. And homeowners make good use of compost in outdoor gardens, planter boxes, around trees and shrubs, and also for indoor house plants.

Additional resource information:

[U.S. Composting Council](#)

[National Geographic — Check Video](#)

Books

Worms Eat Our Garbage: Mary Appelhof, ISBN: 0-942256-05-0

Cornell Composting: Composting in Schools

Garbage Basics

As the U.S. population grows, along with the variety and amount of products we use, so does the amount of garbage Americans generate annually. According to the U.S. Environmental Protection Agency (EPA), generation of municipal solid waste has increased from 88 million tons in 1960 to 254 million in 2010. On average, each individual person generates about 4.5 pounds a day.

What is “Municipal Solid Waste?”

Municipal solid waste, or MSW, is all the garbage, including organics like grass and leaves, generated by households, commercial sites (restaurants, stores, offices, etc.), and institutions (schools, museums, public parks, etc.). Materials such as packaging and office paper from small- to mid-size factories, called “light industrial sites,” are also part of this mix. The ebb and flow of materials that make up MSW is called the municipal solid waste stream.

The Integrated Waste Management Hierarchy

The best way to manage MSW is not to create it in the first place. After that, using management options that maximize recovery, reuse of materials, and minimize disposal is best. The EPA has outlined a hierarchy that prioritizes integrated waste management options. Most communities use some or all of these:

Source Reduction and Reuse: Source reduction is any effort to reduce, at the source, the quantity of waste generated, lessening the amount of material entering the waste stream or being discarded as garbage. Source reduction also includes redesign or modification of a product, its packaging, and/or the product manufacturing process to create less waste.

Recycling: Recycling is the collection and processing of used materials, products, and packaging so that they can be sold to manufacturers for use as a raw material to make new products. Some products, like glass bottles and corrugated cardboard, can be recycled back into the same product. Other recycled materials are used to make different products. [Lesson](#)

Composting: Composting is the aerobic, biological decomposition of organic materials. Living microbes combine with oxygen to cause decomposition. The end result is a nutrient-rich soil-additive called “compost.” Composting yard trimmings, food, and other organic residuals is nature’s way of recycling. Because yard trimmings and food are such a large part of the waste stream, composting can divert a lot of this material to beneficial use. [Lesson](#)

Waste-to-energy: Waste-to-energy (WTE) is when municipal solid waste is burned in a controlled environment to create steam or electricity. Through this process, the volume of solid waste is reduced by about 90%. Energy is sold to electric generating utilities, which distribute to homes and businesses. Before combustion, recyclables are typically removed.

Landfilling: After source reduction, recycling, and composting, a portion of municipal solid waste must still be placed in landfills. Waste-to-energy facilities also produce ash or waste that is placed in landfills. A landfill is where garbage is deposited and then buried. Properly managed landfills are an environmentally safe means of disposal. The EPA as well as state and local authorities closely monitor them for their environmental impact. [Lesson](#)

Landfills may also be a source of ‘green’ energy anaerobic decomposition of organic waste and burning of this fuel source to generate electricity.

Most recyclables are collected at the curb or through drop-off centers. Residents may also be able to take recyclables to buy-back centers. In some states, they may participate in deposit/refund programs. After collection, most recyclables are taken to a materials recovery facility (or MRF) to be sorted and processed into marketable commodities for manufacturing.

Curbside: Curbside collection includes dual-stream, single-stream, or pay-as-you-throw systems. In a dual-stream system, residents separate recyclables into two bins—usually containers in one bin and recyclable paper in another.

Single-stream collection, a growing trend, is where all recyclables are placed in one bin, usually a large wheeled, lidded cart. The primary concern with single-stream collection is that it tends to lower the quality of materials collected because of contamination when materials are combined. On the other hand, it also tends to increase participation and the amount of recyclables collected.

Pay-as-you-throw (PAYT) is a system for both trash and recycling collection. With PAYT, residents pay a fee per bag of trash, and then recycling collection is offered at no-cost or reduced-cost, as a way to encourage more recycling.

Drop-off: Drop-off is when residents take their recyclables to a local collection center, typically located in a public space, retail location, or at the recycling processing facility. Drop-off centers tend to generate fairly clean material as residents sort recyclables at the site into collection bins (some allow commingled); however, they are not as convenient for residents as curbside collection.

Buy-back and Deposits: Buy-back centers are places where residents can turn in their recyclables for cash, based on current market values. Container deposit legislation, or “bottle bills”, currently exists in 11 states. A deposit on various beverage containers is collected when the beverage is sold. When the container is returned to an authorized redemption center, the deposit is partially or completely refunded. Unclaimed deposits are often used by the government to fund environmental programs and/or used to cover the cost of processing returned containers. These types of laws tend to encourage recycling and can help reduce litter.

Hazardous and Special Wastes

According to the EPA, Americans generate over 1.6 million tons of household hazardous waste annually. Products such as paint, pharmaceuticals, cleaners, used oil, batteries, light bulbs, pesticides, and other products that contain potentially hazardous ingredients require special care when disposed of. Most communities offer permanent collection facilities or special collection days for safe recycling or disposal. Other special wastes, such as electronics or e-waste, tires, printer cartridges, cell phones, etc. can often be recycled by returning them to retailers, through mail-back programs, or local special collections.

What is “Zero Waste?”

The goal of zero waste, a growing movement, is to maximize recycling, minimize waste, reduce consumption, and ensure that products are made to be reused, repaired, or recycled back into the marketplace or returned to nature. Ultimately, the goal is to move toward the generation of no waste.

Resources

Go to kab.org for more on waste reduction and recycling. And visit the following resources for specific information:

www.cancentral.com (aluminum can recycling)

www.compostingcouncil.org (composting)

www.container-recycling.org (container deposits)

www.earthg11.org

www.paperrecycles.org (paper recycling)

www.plasticsrecycling.org (plastic recycling)

www.recyclecurbside.org www.recycle-steel.org (steel recycling)

www.epa.gov (U.S. Environmental Protection Agency)

www.wte.org (Energy Recovery Council)

www.zerowaste.org (Zero Waste Alliance)

<http://iwanttoberecycled.org> (Keep America Beautiful's "I Want To Be Recycled" PSA campaign)

Landfills

After source reduction, recycling, and composting, a large portion of municipal solid waste (MSW) still goes to landfills. While disposal of waste to landfills has decreased, it remains the primary disposal option for MSW. [Lesson](#)

A municipal solid waste landfill is where household waste is deposited and buried. Properly managed landfills are an environmentally safe means of disposal, closely monitored for their environmental impact by the U.S. EPA, as well as state and local authorities.

The number of landfills in the U.S. has steadily declined over the past two decades, but has remained relatively constant since 2002. The average size of landfills, however, has increased. While landfill capacity is largely sufficient, it may be limited in some communities.

Landfill Standards

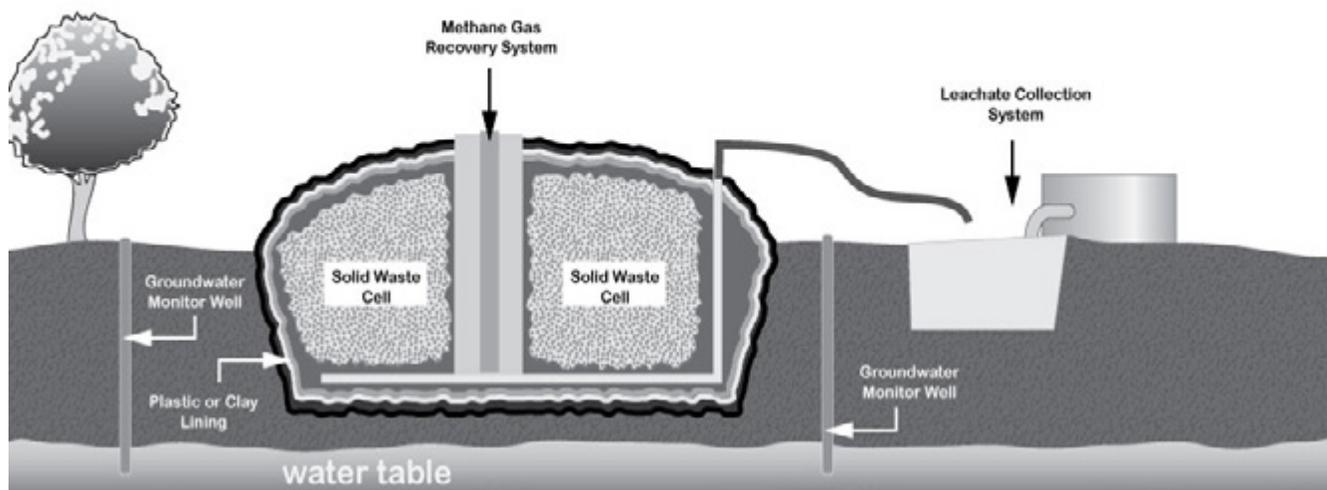
Modern landfills are well-engineered facilities that are located, designed, operated, and monitored to ensure compliance with federal regulations, and to protect the environment from contaminants that may be present in the solid waste stream.

Regulations for MSW landfills appear under Subtitle D of the Resource Conservation and Recovery Act passed by Congress in 1976. In 1991, the U.S. EPA published a supplemental set of Landfill Rules, which now serve as the basis for state regulatory and permitting requirement.

Standards for MSW landfills include restrictions on location, requirements for liners, collection and removal systems for leachate, operating best practices, groundwater monitoring, and closure requirements. New landfills may also collect potentially harmful landfill gas emissions, such as methane, and convert them into energy.

Because today's landfills need to operate with unquestioned safety and efficiency, it often can take five or more years from the site's selection before design, permit application, and public hearings are completed, and construction begins.

Cross-Section of a Modern Landfill



How a Landfill Works

A typical landfill consists of a series of sections called "cells." Solid waste arrives in the "working face," which is a portion of a landfill cell that is currently available to accept materials.

Limited sites in a landfill remain exposed at any given time to minimize exposure to environmental elements like wind and rain. Because a landfill receives new material so systematically, landfill operators may be able to pinpoint where a specific load of garbage ended up days, weeks, or even months afterward.

At the conclusion of each day's activity in a cell, a "daily cover" is spread across the compacted waste to minimize odor, prevent windblown litter, and deter insects and vermin. The daily cover may include a layer of dirt, clay, foam, tarps, sand, or sometimes finely crushed glass. The landfill operator moves from working face to working face and from cell to cell as the landfill gradually reaches its capacity over a period of years, or even decades.

Environmental Safeguards

We construct modern landfills with a number of safeguards, including clay or plastic lining to contain leachate. Rain, snow, and liquids created by the compaction and decomposition of solid waste, which can seep through a landfill cell, is called "leachate." Leachate is a potential pollutant of surface waters (lakes, rivers, streams or oceans) or groundwater, which is the source of most drinking water.

Protective liners prevent filtration of liquid from the landfill. Liners may be made of compacted clay or impermeable materials such as plastic, or both. When clay is used, the layer may be as much as 10 feet thick. This site preparation ensures any liquid entering the landfill can be controlled and treated externally, or retained inside the landfill, rather than passing through.

Beyond protective liners, modern landfills include multiple safeguards to contain leachate and other waste and waste byproducts, and isolate them from surrounding water and soil. To prevent leachate contamination, a network of drains at the bottom of the landfill collects the liquid that has percolated through the solid waste. Leachate then travels to waste water recovery points for treatment.

Groundwater monitoring wells are also installed around the perimeter of the landfill to ensure that surrounding groundwater is not contaminated with leachate. Should a liner system fail by breaking or deteriorating, leak detectors installed under the liners signal the presence of leachate, allowing corrective action to prevent any movement of leachate from the landfill toward nearby ground or surface waters.

Landfills and Gas Emissions

Gases emanating from the landfill are also monitored and controlled. The organic portion of waste (e.g., food and yard wastes) decomposes, producing large amounts of methane, a greenhouse gas, and carbon dioxide. Under the Resource Conservation and Recovery Act and the Clean Air Act, landfill operators are required to monitor gas both on the surface and around the boundaries of landfills.

As cells to the landfill are sealed off, venting systems are installed to prevent methane from diffusing into the ground, and to collect any gas released and burn it off. The gas can also be collected and used to generate electricity for use on site, or to sell for residential or business use.

Closing a Landfill

When a landfill has reached its capacity, it is required to close consistent with U.S. EPA “final cap” environmental requirements. A final layer of plastic, clay, and topsoil cap the landfill.

It is then re-landscaped according to closure plans drawn up in accordance with the community. This process involves many years of planning. To earn a license to operate, a landfill operator must have a complete plan for the site’s eventual closure. The operator is also required to set aside necessary financial resources for all closure, post-closure, and corrective activity—the need for which may arise over the lifetime of the landfill.

Once a landfill is capped and closed, operators are obligated to monitor the site for gas and leachate for at least 30 years, and may be involved in ongoing efforts to reclaim the land for other uses. Landfills can end up as open space for communities to use as parks, or other recreational facilities. Building any permanent structure on landfills is less common because, as solid waste decomposes in the landfill, the entire landscape can settle. A structure on the site could break the “cap,” allowing water to percolate through the garbage and potentially allow the release of methane gas.

Additional Resources:

[3-minute video of a Landfill operation](#)

[Article and photos of Landfill design](#)

Litter Prevention

Why Do People Litter?

Litter is misplaced, improperly handled waste. In a three-year research project, Keep America Beautiful (KAB) found that people litter for one of three reasons. They feel it's acceptable to litter because:

- ▶ They feel no sense of ownership for the property;
- ▶ They believe someone else will clean up after them; or
- ▶ Litter has already accumulated.

From Where Does It Come?

Although motorists and pedestrians are most often blamed for litter, KAB identified sources that contribute to the problem. The common sources of litter are:

- ▶ Motorists
- ▶ Pedestrians
- ▶ Uncovered vehicles
- ▶ Loading docks
- ▶ Commercial refuse sources, including dumpsters
- ▶ Household trash handling
- ▶ Construction/demolition sites

From these sources, litter is carried in every direction by wind, water, traffic, and animals. It moves until trapped by a curb, a wall, a fence, a row of trees, a building, or other stationary objects. Trapped, litter becomes not only an eyesore, but an invitation for others to litter.

In the landmark 2009 "Litter in America" study, KAB's research indicated that 15% of individuals sampled reported littering in the past month. In 1969, 50% admitted littering. While littering rates have declined in the past 40-plus years, individual littering—and litter—persists.

Littering is primarily the result of individual behaviors. About 85% of littering is the result of individual attitudes about litter. Changing behavior is the key to preventing litter. Nearly one in five, or 17%, of all disposals observed in public spaces were littering. Most littering behavior - 81% - occurred with notable intent. A strong contributor to littering is the prevalence of existing litter. Most littering occurs at a considerable distance from a receptacle.

According to the KAB research, at the time of improper disposal, the average estimated distance to the nearest receptacles was 29 feet. The observed littering rate when a receptacle was 10 feet or closer was only 12%; thus, the likelihood of littering increased for receptacles at a greater distance. Individuals younger than 30 years of age are more likely to litter than those who are older. In fact, age, and not gender, is a significant predictor of littering behavior.

To make a difference and prevent littering:

- ▶ Provide sufficient trash, ash, and recycling receptacles;
- ▶ Littered environments attract more litter so ensure consistent and ongoing cleanup efforts;
- ▶ Use landscaping, improving the built infrastructure, and ongoing maintenance to set a community standard and promote a sense of personal responsibility not to litter; and
- ▶ Use awareness and motivational campaign messaging that highlights social disapproval for littering and a preference for clean communities. (Don't show littered areas, which reinforces rather than discourages littering behavior.)

The Cost of Litter

Litter is a costly problem. City, county, and state highway departments spend millions of dollars and many hours each year cleaning up litter—money and time that could be used for more necessary services. Cleaner communities also have a better chance of attracting new businesses than those where litter is commonplace. Additional information is available at kab.org.

Keep America Beautiful's Top 10 Tips for Preventing Litter

- ▶ There are many ways that you can help make your community cleaner. Here are 10 suggestions:
- ▶ Set an example by not littering. Carry a litter bag in your car or put litter in your pocket until you find a container.
- ▶ Pick up one piece of litter every day.
- ▶ Teach others the proper way to dispose of trash. Show them the difference between a clean area and an area spoiled by litter, and stress why it's important to put trash in proper containers.
- ▶ Make sure that your trash cans have lids that can be securely attached. If you have curbside trash service, don't put out open containers or boxes filled with trash.
- ▶ Ask your neighbors to join you in cleaning up a public area where litter has accumulated. Ask your local government to become involved by collecting the bags of litter, or by waiving the disposal fee at the landfill or solid waste facility.
- ▶ Tie papers in a bundle before placing them in a curbside recycling bin. Loose papers can be blown out by the wind as can other recyclables. (Check local requirements and share information with neighbors.)
- ▶ If you or a member of your family is involved in a civic group, scouting, or recreational sports program, encourage the group to become involved in a cleanup. In some communities, groups can earn cash by separating recyclable products from litter and redeeming them. Have the group "adopt" a spot and maintain it on a regular basis.
- ▶ Find out how you can plant and maintain flowers along a curb or sidewalk. People litter less where areas have been beautified.
- ▶ Ask business owners to check their dumpsters every day to make sure tops and side doors are closed. If the business has a loading dock, ask them to keep it clean, and to put out a receptacle for employees to use.
- ▶ If you own a construction or hauling business, make sure your trucks are covered when transporting material to and from sites. Use fencing around construction or demolition sites to prevent debris from being blown into other areas. Put trash containers at the site and on every floor for construction workers.
- ▶ The most successful way to prevent littering in your community is to have an ongoing, organized program that involves local government, businesses, civic groups, the media, schools, and citizens.

Recycling

Recycling helps create the products we use every day—from beverage containers to writing paper, carpet, and automobiles. Recycling recovers valuable materials out of the waste stream to make new products. That's what makes it one of the oldest environmental practices and one of the most beneficial.

Benefits of Recycling Lesson

According to the U.S. EPA, recycling:

- ▶ Conserves natural resources to help sustain the environment.
- ▶ Reduces the need for landfilling and incineration.
- ▶ Saves energy and prevents pollution caused by the extraction and processing of virgin materials.
- ▶ Decreases emissions of greenhouse gases.
- ▶ Expands U.S. manufacturing jobs and increases U.S. competitiveness.

Recycling Today

American communities currently recycled and composted just over 33.8% of municipal solid waste, diverting 82 million tons to recovery out of 243 million tons of trash generated. While nearly three-quarters of Americans have access to curbside programs and 92% have access to "some sort of recycling," the national participation averages 50%. Keep America Beautiful estimates that only about 12% of public spaces may have recycling receptacles, according to research completed in 2009.

The challenges and motivators of recycling revolve around issues such as citizen's access to recycling programs, participation rates and incentives, and fluctuations in the global recycled materials commodity markets.

The Recycling Loop

According to the EPA, the recycling process involves three main steps, which form a loop. They are (1) collection and processing, (2) manufacturing, and (3) buying recycled products. The loop ensures the overall success and value of recycling.

Collection and Processing

Recycling collection varies from community to community but primarily the collections methods are curbside, drop-off centers, buy-back centers, and deposit/refund programs. The system works when individuals take ownership and place items in the bin for recycling. If the individual doesn't make the choice to recycle versus dispose of, the cycle doesn't work. After collection, recyclables go to a materials recovery facility (MRF) to be sorted and prepared into marketable commodities. Recycled materials are like any commodity, so prices for the materials change and fluctuate with global market demand and quality of the raw materials.

Manufacturing

The second part of the recycling loop is when materials become new products. Today, more and more manufactured products contain total or partial recycled content. Many of these products will become the original product in what we call "closed-loop recycling." For example, glass, aluminum, and steel become new bottles and cans, and cardboard becomes new boxes. Recycled plastics become new bottles, carpeting, park benches, as well as fibers for clothing. Another innovative application includes using recovered glass in roadway asphalt (glassphalt).

Buying Recycled Products

The third part of the recycling loop is the purchase of recycled products. Government, business, and individual consumers play an important role by "buying recycled." According to the EPA, "As consumers demand more environmentally-sound products, manufacturers will continue to meet that demand by producing high-quality recycled products."

Identifying Recycled-Content Products

Product labels can be confusing to consumers interested in buying recycled because of the different recycling terminology used. The following definitions from the Federal Trade Commission's "Guides for the Claims" may help clarify the terms.

Recycled-content products are made from materials that would otherwise have been discarded. Items in this category are made totally or partially from material destined for disposal or recovered from industrial activities—like aluminum soda cans or newspaper. Recycled-content products also can be items that are rebuilt or remanufactured from used products such as toner cartridges or computers.

Postconsumer content refers to material from products that were used by consumers or businesses and would otherwise be discarded as waste. If a product is labeled "recycled content," the rest of the product material might have come from excess or damaged items generated during normal manufacturing processes—not collected through a local recycling program.

Recyclable products can be collected and remanufactured into new products after they've been used. These products do not necessarily contain recycled materials and only benefit the environment if people recycle them after use. Check with your local recycling program to determine which items are recyclable in your community.

What Gets Recycled?

Acceptable recycling in each community depends on recycling markets and processing technologies. The recent *EPA Municipal Solid Waste Generation, Recycling, and Disposal in the United States* report states we recycled and composted 1.46 pounds of our individual waste generation of 4.34 pounds per person per day.

Aluminum

Aluminum has a long history of recycling. Recycling aluminum may save up to 95% of the energy needed to produce new aluminum from raw materials (mainly ore bauxite). Although aluminum is a nonrenewable resource, it can be recycled indefinitely. Recycled cans are melted into ingots weighing up to 60,000 pounds – enough aluminum to make 1.6 million new cans. It takes 60 days for a can to journey from the recycling bin through the recycling process and back to store shelves.

Besides cans, other types of aluminum, such as siding, gutters, car components, storm window frames, and lawn furniture can also be recycled. Learn more online at the Can Manufacturers Institute (www.cancentral.com) and the Aluminum Association (www.aluminum.org).

Electronic Waste

Electronic waste, or e-waste, includes such items as computers, phones, and TVs. While recycling of these discarded products is growing, e-waste continues to generate at a much faster rate than other municipal wastes. For comprehensive national information on donating and recycling electronics, visit the U.S. EPA's Plug-In To e-cycling program at www.epa.gov.

Wireless Phones - Cell or smart phones or PDAs can be recycled through community collection programs or retailer return programs, or donated to charity. Recycling phones saves energy and keeps usable materials out of the landfill. These products are made of precious metals, copper, plastics—some of which require energy to mine or manufacture. Recycling allows these materials to be recovered and turned in to new products. For more information, visit CTIA –The Wireless Association at recyclewirelessphones.org.

Computers - Donating a working computer for reuse benefits communities, helps use valuable materials wisely, and keeps working PCs out of the trash. Computers can also be recycled through most state and local computer collection programs. Many computer manufacturers and retailers have a recycling take-back program. Obsolete computers are potentially a valuable source for secondary raw materials, such as lead, copper, and gold. They also contain hazardous substances, so it's important to ensure that they are recycled properly.

Televisions - As more households upgrade technologies—transitioning from analog to digital technology and from boxy, cathode ray tube (CRT) to flat panel televisions— more old TVs will need to be safely recycled. Old televisions contain lead, copper, steel and aluminum that can be recovered through recycling. Recycling TVs helps to conserve natural resources and energy, as well as keeping potentially hazardous wastes out of the environment.

Glass

Glass container manufacturers use up to 70% cullet, or crushed glass, combined with soda ash, limestone and sand, to make new glass containers. Glass bottles can be recycled endlessly with no loss in quality or purity. Using recycled glass to make new glass bottles and jars reduces consumption of raw materials, extends the life of plant equipment, such as furnaces, and saves energy.

Today, most glass is collected mixed, but eventually the glass must be sorted by color (clear, green, and amber), or it has limited value to container manufacturers. After being processed at a materials recovery facility, most glass then goes to a cullet processor for further cleaning and sorting to prepare the cullet to be “furnace ready.”

Like all recycled commodities, quality of glass cullet is important to its recyclability. Glass contaminants include ceramic cups and plates, clay pots, drinking glasses, light bulbs, and mirror and window glass. Recycled glass that does not meet specifications for use in making new bottles can be used for fiberglass, countertops and flooring, landscaping, road bed, abrasives, filtration, and as a blasting media. For more information, visit the Glass Packaging Institute. (www.gpi.org)

Paper

There are many different types of recyclable paper, called grades. While paper fibers cannot be recycled forever, paper is made from a renewable resource, trees. Today, paper is made from trees mostly grown in crop forests and from recovered paper. When paper is recycled, paper mills will use it to make new newspapers, notebook paper, paper grocery bags, corrugated boxes, envelopes, magazines, cartons, and other paper products.

Besides using recovered paper and pulp from trees to make paper, paper mills may also use wood chips and sawdust left over from lumber operations (whose products are originally used to make houses, furniture, and other things). New paper products in the U.S. today are coming more and more from recycled sources.

Office paper recovered for recycling becomes raw material for paperboard, tissue, and printing and writing papers. Most recycled corrugated boxes are made into new boxes. The rest is used for paperboard packaging, such as food packaging boxes. Newspapers recovered for recycling are mostly going back into making more newsprint, and the remainder used for paperboard, tissue, and insulation, or exported. Find out more at www.paperrecycles.org.

Plastics

Most plastic products are derived from petroleum hydrocarbons. There are several different types of plastics, but the most widely used and recycled are "PET" (polyethylene terephthalate), or #1-plastic and "HDPE" (high-density polyethylene), #2 plastic. PET plastic is mostly soft drink and water bottles. HDPE plastic includes bottles/jugs for milk, juice, water, and laundry products.

More than 95% of all plastic bottles are either PET or HDPE. The remaining 5% are various types of plastic that can be difficult to recycle in all communities because of limited markets. In some communities, plastic bags are recycled at collection programs offered through national grocery and retail chains.

Some recycled PET is being used as a raw material for new plastic bottles. The rest is used to create second-generation products like fiber, tote bags, clothing, film, food and beverage containers, carpet, strapping, fleece wear, and luggage. HDPE plastic is often recycled into bottles for liquid laundry detergent, shampoo, conditioner, and motor oil, as well as used to make recycling bins, benches, and plastic lumber. Learn more at www.americanchemistry.com/plastics, www.napcor.org and <http://www.plasticsrecycling.org/>.

Scrap Tires

Environmentally sound and economically viable markets for scrap tires recovered for recycling are tire-derived fuel, civil engineering, and ground rubber applications. Tire-derived fuel markets account for most of the scrap tires generated. Ground rubber applications include new rubber products, playground and other sports surfacing, and rubber-modified asphalt. Tires recovered and used in civil engineering projects include things such as tire shreds used in road and landfill construction. Ensure proper handling of scrap tires as stockpiles can create the potential for fire, as well as conditions for mosquito propagation. Find out more from the Rubber Manufacturers Association. (www.rma.org)

Steel

Scrap steel has become the steel industry's single largest source of raw material because it is economically advantageous to recycle old steel into new steel. In light of this, steelmaking furnaces have been designed to consume steel scrap. The steel industry uses scrap steel from recycled cans, automobiles, appliances, construction material, and other steel products. Recovered steel can be melted and used repeatedly to produce new steel products.

Recycling steel helps save landfill space and provides a valuable resource to the steel industry. It also preserves natural resources and energy. For every ton of steel recycled, 2,500 pounds of iron ore, 1,400 pounds of coal and 120 pounds of limestone are conserved. And in a year, the steel industry conserves the equivalent energy to power about 18 million homes for 12 months. Learn more at the Steel Recycling Institute. (www.recycle-steel.org)

Resources

I Want To Recycled PSA Campaign – <http://iwanttoberecycled.org>

U.S. Environmental Protection Agency, Office of Solid Waste – www.epa.gov/osw

Curbside Value Partnership – www.recyclecurbside.org

Earth911 – www.earth911.org

Federal Trade Commission Sorting Out "Green" Ad – <https://www.ftc.gov/news-events/press-releases/1999/04/ftc-releases-revised-consumer-brochure-about-green-claims>

Aluminum – www.cancentral.com

Aluminum – www.aluminum.org.

Glass – www.gpi.org

Paper – www.paperrecycles.org

Phones – www.recyclewirelessphones.org

Plastics – www.americanchemistry.com/plastics

Plastics- www.napcor.org

Plastics – <http://www.plasticsrecycling.org/>

Rubber – www.rma.org.

Steel – www.recycle-steel.org

Source Reduction

Source reduction is the top solid waste priority of the U.S. Environmental Protection Agency (EPA). Source reduction stops waste before it starts by decreasing the amount of materials used during the manufacturing or distribution of products and packages. Typically, this process also results in less energy to manufacture and transport thereby reducing emissions from energy consumption such as carbon dioxide. In addition, source reduction cuts back on what needs to be thrown away and helps keep solid waste disposal costs down.

Some specific examples of source reduction practices are:

- ▶ Redesigning products to use fewer materials (lightweighting, material substitution)
- ▶ Reusing products and materials (refillable water bottles)
- ▶ Extending the useful lifespan of products (increased time for a rechargeable battery)
- ▶ Avoiding using materials in the first place (reducing junk mail)

Many packages use new designs to use less material called "lightweighting," but remain just as strong. Lightweighting means redesigning a package to use less material, which also tends to make it weigh less. As early as 1983, companies manufacturing food service disposables began reducing waste by decreasing the paper stock required to manufacture food service containers and coating the containers with a very thin layer of polyethylene or wax. The coating enables the container to maintain its strength and food-protection functions. Manufacturing of all types—plastic, paper, glass, steel, and aluminum— have examples of lightweighting. The glass container initiative has been termed right-weighting, rather than lightweighting. Aluminum beverage cans are now 26% lighter than they were in 1972. Plastic two-liter soft-drink containers are 21% lighter than in 1977 and 16-oz glass beverage bottles are now 30% lighter than 10 years ago.

Source reduction in product packaging isn't always easy to find. Sometimes the easiest way is to look for the same type of product in different packages, or use these suggestions:

- ▶ Buy a concentrated product. Concentrates come in containers that use less packaging material per product usage and use 15%-50% less packaging than other similar non-concentrated products.
- ▶ Buy the large or economy size container you can use efficiently. These products may use less packaging in the long run.
- ▶ Buy refill systems. These containers hold product that pours into an empty primary container for use. This method uses 15%-80% less packaging than primary containers.
- ▶ Buy combination products, such as laundry detergent with bleach or fabric softener in one package.
- ▶ Buy packages made with recycled materials. The content in recycled plastic containers may range from 25%-100%.

Source reduction is not the same as recycling. Recycling is collecting already used materials and making them into another product. Recycling reduction first takes place at the product's—and its packaging— design. The best way to think about source reduction and recycling are as complementary activities; combined, source reduction and recycling have a significant impact on preventing solid waste and saving resources.

Recyclability and recycled content play an important role in packaging. Products may be marked in a variety of ways with the recycling chasing arrows symbol. The traditional recycling symbol means the product is recyclable. This logo has no regulation, however, nor is there a national standard. Products marked with the word "recyclable" or with the recycling symbol may or may not contain recycled material.

If the recycling symbol has a circle around it,  the product contains recycled content. Products and/or their packaging made with recycled content may use the word recycled, the phrase "made of recycled materials," and phrases with similar meaning. The product information may also include the percentage of post-consumer waste included in the material. This phrase occurs frequently on paper products.

A product's "recyclable" nature is dependent upon global recycling markets. If there isn't a manufacturer making a new product from a recyclable commodity, there is no need to collect and process the material, because there is no demand to use it as feedstock for a new product. Recycling markets are an excellent example of supply and demand.

We can make packaging more sustainable by applying the principles of product stewardship— a product-centered approach to environmental protection. It calls on those in the product lifecycle— manufacturers, retailers, users, and disposers—to share responsibility for reducing the environmental impacts of products. Principles include: eliminating toxic constituents; using less material; making packaging more reusable; using more recycled content; and/or making it more readily recyclable. Many countries require manufacturers to take back packaging discards or pay for their recycling. There are no federal-level packaging mandates of a similar nature in the United States.

LINKS

Source Reduction Canada Youth Led Project <http://www.youtube.com/watch?v=w4j8guZ1YcQ>

ExxonMobil Plastics Down-gauging/Lightweighting <http://www.exxonmobilchemical.com/Chem-English/sustainability/sustainability-plastics-downgauging.aspx>

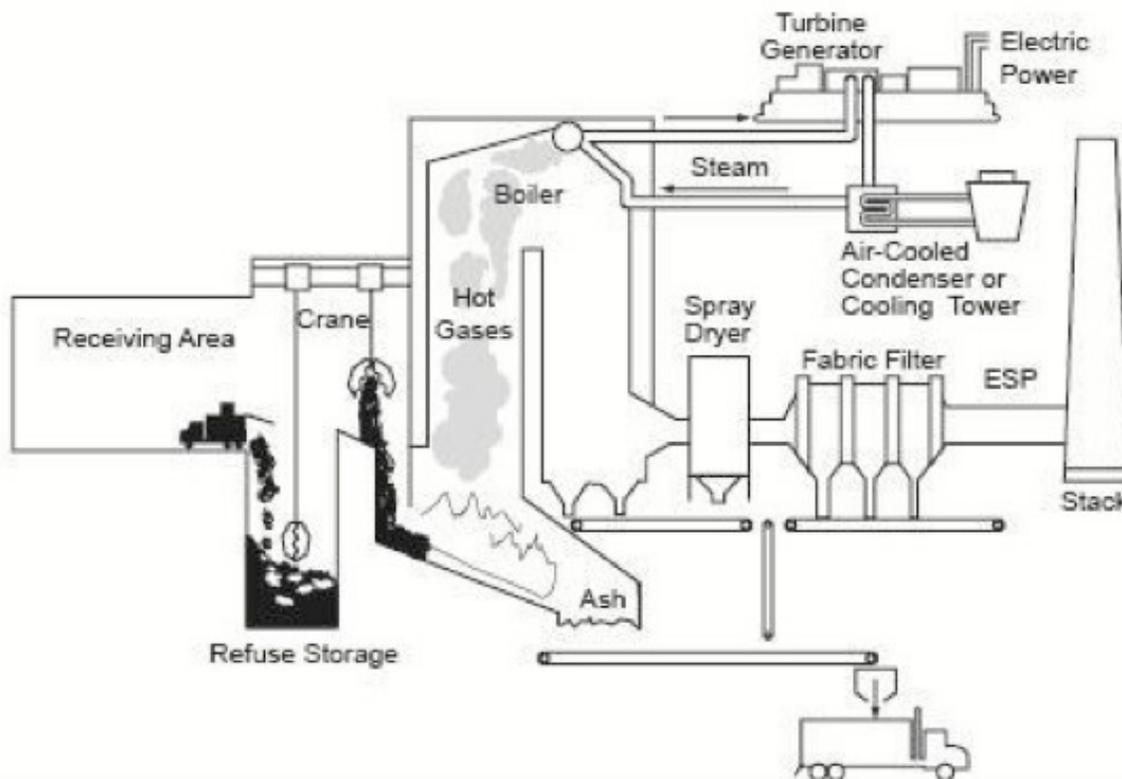
Environmental Impacts of Source Reduction
<http://www.epa.gov/climatechange/>

Waste-to-Energy

[Click!VIDEO of How a WTE Plant works](#)

Waste-to-energy (WTE) is what occurs when municipal solid waste burns in a controlled environment to create steam or electricity. Through this process, the volume of solid waste reduces by about 90%. Electric generating utilities purchase the resulting energy and distribute it to homes and businesses. Every ton of trash turned in to energy is the equivalent of using one less barrel of oil or one-quarter ton less coal. The U.S. EPA has also recognized WTE, along with recycling and other materials management practices, with a reduction in greenhouse gas emissions. Lifecycle studies show that WTE reduces one ton of carbon dioxide equivalents for every one ton of trash it processes. Waste-to-energy has also proven compatible with recycling. A 2008 study of U.S. communities using WTE were found to have an aggregate recycling rate above the national average. Several factors caused these findings, including on-site recycling efforts at WTE plants, the importance a community places on recycling as part of a comprehensive solid waste management plan, and the economics of recycling.

Schematic of a Waste-to-Energy Plant



Primary WTE Technology Options

Three primary WTE technology options are available:

Refuse-Derived Fuel (RDF)

RDF plants—one-fifth of the U.S. municipal solid waste incinerators—process solid waste before burning it, so that recyclables can be removed. This process includes non-combustible items such as glass, metals, and other recyclable materials. Each year they recover more than 700,000 tons of ferrous metals for recycling. The remaining solid waste is shredded into smaller pieces/fluff for burning. RDF is burnable in power boilers at factories or even at large housing complexes.

Sometimes RDF materials are "densified" (compacted at high pressure) to make fuel pellets. The "pellet fuel" may also include various sludges – by-products of municipal or industrial sewage treatment plants. A major advantage of pellet fuel as an RDF is that it can burn along with other kinds of fuel in existing power boilers. This means RDF pellet fuels can compete with traditional fuels, such as coal, on the open market.

Mass Burn

Mass burn is combusting municipal solid waste without any pre-processing or separation. The resulting steam applies to industrial uses or for generating electricity. Mass burn facility sizes depend on the daily amount of solid waste they expect to receive. Most mass burn plants can remove non-combustible steel and iron for recycling before combustion using magnetic separation processes. Other non-ferrous metals are then recovered from the leftover ash.

Modular Incinerators

Modular incinerators are small mass burn plants, with a capacity of 15 tons to 100 tons per day. The boilers for modular incinerators are built in a factory and shipped to the WTE site, rather than on the WTE site itself. The advantage of a modular WTE incinerator is flexibility. For example, if more capacity is needed, modular WTE units can be added. Primarily small communities and industrial sites use these facilities. Costs limit the use of this technology because the return on investment in terms of energy produced over time is much lower than in mass burn plants.

Ash Management

Two types of ash are produced as a result of waste-to-energy generation:

Bottom ash includes both large- and moderate-sized unburned and unburnable matter, which remains after the municipal solid waste has passed through the furnace, or combustion chamber. This ash comprises 75%-90% of all ash produced through WTE, depending on the technology employed.

Fly ash is a powdery material suspended in the gas stream, which is collected in the pollution control equipment. It tends to have higher concentrations of metals and organic materials.

Bottom ash and fly ash are usually combined when collected to facilitate storage, handling, and transportation. A benefit of combining them is that this helps bind metal particles to other materials, reducing the potential that these metals will leach into groundwater once they are disposed.

By law, all ash is tested in accordance with U.S. EPA rules before leaving the WTE facility to ensure it is safe for disposal or beneficial reuse. According to the U.S. EPA, about 10% of the total ash formed in the combustion process is used as daily cover in landfills, road construction, and other beneficial uses.

Air Emissions

Burning any fuel, including municipal solid waste, can produce a number of pollutants, such as carbon monoxide, sulfur dioxide, and fine particles containing heavy metals. Other toxic organic compounds, such as dioxins, are also potential emissions from any combustive activity where certain chemical compounds are present, a situation that could take place in the WTE process.

U.S. EPA Standards

To mitigate the level of these compounds released into the air and their impact on human health and the environment, the U.S. EPA established, effective 1995, among the most stringent environmental standards for WTE facilities in the world. These rules mandate that all facilities use the most modern air-pollution control equipment available to ensure that WTE smokestack emissions are as clean as possible, and are safe for human health and the environment.

Pollution Control Technologies

A variety of pollution control technologies significantly reduce the gases emitted into the air, including scrubbers to control acid gas, fabric filters to control particulate, selective non-catalytic reduction (SNCR) to control nitrogen oxides, and carbon injection to control mercury and organic emissions. Burning waste at extremely high temperatures also destroys chemical compounds and disease-causing bacteria.

In a properly operated facility, air making its way through the pollution control technologies and into the smokestack is "clean" by U.S. EPA standards. Smokestack height is an extra, final precaution taken to assure that remaining pollutants in the gas stream do not reach the ground in a concentration that could possibly be harmful.

Resources

[Energy Recovery Council](#)

[U.S. EPA](#)



Fast 5 Fact Sheet

Fast 5: Composting

Youth Advisory Council Video

What:

Composting is the aerobic, biological decomposition of organic materials. Living microbes combine with oxygen to cause this breakdown. The result is a nutrient-rich, soil-additive called "compost." Composting is true closed-loop recycling as it returns organic materials back to the earth.

Who:

The University of Missouri has a composting program for food scraps that creates a Zero Carbon Footprint. Cafeteria food scraps are composted to create fertilizer for growing vegetables for the cafeteria and biodiesel from the cooking oils in the cafeteria fuel the transportation of the trucks hauling the food scraps and returning the fertilizer/compost. Tractors and other equipment are also fueled with the biodiesel. <http://www.slideshare.net/Reinbott/composting-in-a-zero-carbon-footprint-system>

When:

Composting can take place anytime and anywhere. References to composting can be found in 10th century Arab texts, medieval Church texts, and in Renaissance literature. In North America notable composters include George Washington, Thomas Jefferson, and George Washington Carver.

Where:

While most people will compost at home or at school you should really watch the video of Cedar Grove Composting facility, the largest composting facility of its kind in the world. [Massive!](#)

Why:

Using compost has important environmental benefits:

Enriches the soil, reducing the need for water, fertilizers, and pesticides.

Helps clean up or remediate contaminated soils.

Prevents pollution. Diverting organics from the waste stream ultimately avoids the production of methane and leachate in the landfills. Compost can also help stop pollutants in storm water runoff from reaching surface water resources.

Prevents soil erosion and silting on embankments parallel to creeks, lakes, and rivers, and prevents erosion and turf loss on roadsides, hillsides, playing fields, and golf courses.

Fast 5: Garbage Basics

Youth Advisory Council Video

What:

Municipal solid waste, or MSW, is all the garbage, including organics like grass and leaves, generated by households, commercial sites (restaurants, stores, offices, etc.), and institutions (schools, museums, public parks, etc.). Materials such as packaging and office paper from small- to mid-sized factories, called "light industrial sites" are also part of this mix. The ebb and flow of materials that make up MSW is called the municipal solid waste stream.

Who:

In the U.S. each individual person generates about 4.5 pounds of garbage per day every day creating **254 million tons** in 2010.

When:

From 1885-1908, 180 garbage incinerators were built in the U.S.

1965	The Solid Waste Disposal Act, the first federal solid waste management law, is enacted.
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Where:

MSW is managed using different options. The EPA calls these options the Integrated Waste Management Hierarchy. A hierarchy is a ranked group; in this case, from the most desired MSW option to the least desired option. The MSW hierarchy is: Source Reduction, Recycling, Composting, Waste-to-Energy, and Landfilling.

Why:

The ever-increasing population means new issues relating to MSW and evolving answers. Sometimes the issues lead to court actions. In 1933, communities on the New Jersey shore obtain a court order forcing New York City to stop dumping garbage in the Atlantic Ocean. On July 1, 1934, the Supreme Court upholds the lower court action, but applies it only to municipal waste, not commercial or industrial wastes.

Fast 5: Landfills

What:

A municipal solid waste (MSW) landfill is where household waste is deposited and buried. Modern landfills are well-engineered facilities that are located, designed, operated, and monitored to ensure compliance with federal regulations, and to protect the environment from contaminants that may be present in the solid waste stream.

Who:

Landfills are regulated by the Environmental Protection Agency as well as state and local laws.

When:

The first "sanitary landfill" began operation in Fresno, Calif., in 1934. This early sanitary landfill simply attempted to reduce odors and vermin by covering the garbage with dirt rather than a simple open pit system.

Where:

Landfills are common throughout the U.S., and while the number of landfills declined steadily until 2002 the size of landfills have increased.

Why:

While source reduction, recycling, and composting are having a positive impact on how we MSW, a large portion still goes to landfills. Landfills remain the cheapest method of disposal of MSW in most communities.

Fast 5: Litter Prevention

Youth Advisory Council Video

What:

Litter is misplaced, improperly handled waste. Littering is primarily the result of individual behaviors.

Who:

In recent Keep America Beautiful research, 15 percent of individuals sampled reported littering in the past month. In 1969, 50 percent admitted littering. While littering rates have declined in the past 40 years, individual littering – and the resulting litter – persists.

When:

A strong contributor to littering is the prevalence of existing litter. Most littering occurs at a considerable distance from a receptacle.

Where:

The "Seven Sources of Litter" are motorists, pedestrians, uncovered vehicles, loading docks, commercial refuse sources (including dumpsters), household trash handling, and construction/demolition sites.

Why:

Keep America Beautiful found that people litter for one of three reasons. They feel it's acceptable to litter because: They feel no sense of ownership for the property; They believe someone else will clean up after them; and Litter has already accumulated.

Fast 5: Recycling

Youth Advisory Council Video

What:

Recycling is a resource recovery method involving the collection and treatment of a waste product for use as a raw material in the manufacture of the same or another product. Recycling is a three-step process, which forms a loop: 1) Collection and processing; 2) Manufacturing; and 3) Buying recycled products.

Who:

According to a 2007 Harris Poll, 77 percent of American adults recycle something at home and that senior citizens (those aged 62 or older) are more likely to recycle at home than those aged 18-30.

When:

The first real recycling program was introduced in New York City in the 1890s. The city built its first recycling plant in 1898. (Source: recyclecurbside.org)

Where:

In the past few years, America Recycles Day averages more than 2 million participants; there are 2,000 registered events; with more than 15,000 organizations taking part.

Why:

There are many benefits of recycling, including:

- ▶ Conserves natural resources to help sustain the environment.
- ▶ Reduces the need for landfilling and incineration.
- ▶ Saves energy and prevents pollution caused by the extraction and processing of virgin materials.
- ▶ Decreases emissions of greenhouse gases.
- ▶ Expands U.S. manufacturing jobs and increases U.S. competitiveness.

Fast 5: Source Reduction

What:

Source reduction stops waste before it starts by decreasing the amount of materials used during the manufacturing or distribution of products and packages.

Who:

An Alcoa study shows "lightweighting and recycling" makes a difference for the transportation industry. Replacing 2 lbs. of steel with 1 lb. of aluminum in a car saves 20 lbs. of CO₂ emissions over the life of the car, and 60 percent of aluminum used in automobiles is from recycled aluminum.

When:

As early as 1983, companies manufacturing food service disposables began reducing waste by decreasing the paper stock required to manufacture food service containers and coating the containers with a very thin layer of polyethylene or wax.

Where:

Lightweighting is not just an aluminum phenomenon, but is used in paper, plastic, steel and glass products. Another source reduction strategy for paper is in page setup for printing. By simply changing the print margins by a half-inch in an average page produces paper savings of 4.75 percent, according to the EPA.

Why:

Typically, this process also results in less energy to manufacture and transport products, thereby reducing emissions from energy consumption. In addition, source reduction cuts back on what needs to be thrown away and helps keep solid waste disposal costs down.

Fast 5: Waste-to-Energy

Youth Advisory Council Video

What:

Waste-to-energy (WTE) is what occurs when municipal solid waste burns in a controlled environment to create steam or electricity. Through this process, the volume of solid waste reduces by about 90 percent. Another WTE process is the production of biogas through anaerobic decomposition using compost digesters. The gas can be used for cooking, heating, and to power generators to produce electricity or converted to a liquid transportation fuel.

Who:

Many people are interested in the development of biogas. Designs of digesters range from small units for families in developing countries to large facilities for regional collection companies to semi-portable units for community landfills.

When:

Each year new WTE facilities are opening around the world. In the first decade of this century, the WTE capacity increased by more than 4 million metric tons.

Where:

Waste-to-energy facilities are popping up everywhere. California is leading the way because of its mandate for utilities and electricity providers to get one-third of their power from renewable sources by 2020.

Why:

Biogas closes the loop for recycling and contributes sustainability.



LESSONS





Litter Prevention

Cache & Trash

High Tech Cleanup

“I'm not an environmentalist. I'm an Earth warrior.”

Darryl Cherney

Concept

Changing the littered environment can change the behavior of people in that environment.

Objective

Students will understand the difference between a behavior and a habit as it relates to littering. Students will use the technologies of Global Positioning System (GPS) and social media (Geocaching.com) to change littering behavior.

Teacher Support and Student Engagement

Request a free poster on how GPS works and watch a video on how it works

<http://www.gps.gov/multimedia/poster/>

Intro to geocaching video 1:16 minutes

<http://www.geocaching.com/videos/default.aspx#cat=PL939C3CBDC2F2F385&vid=1YTqitVK-Ts>

Geocaching Apps for iPhone & Android

<http://www.geocaching.com/live/default.aspx>

Cache In Trash Out Event

<http://www.geocaching.com/cito/>

Upload your photos to Instagram #kabyouth #kabtrashcache. In the comments give the cache site name you are using on [geocache.com](http://www.geocache.com) and "Before" or "After" the cleanup. Please include instructions for uploading photos in your cache box and on the [geocache.com](http://www.geocache.com) site.

Brief

A comparative analysis of the 2008 and 2009 research and the KAB national litter study conducted in 1968 found that education, ongoing clean-up efforts, and changes in packaging are having an impact on littering. The survey shows 15% of individuals self-reported littering in the past month compared to 50% in 1968. While self-reported littering rates have declined littering and litter persists. In a three year study KAB found that one of the reasons people feel it is acceptable to litter is *if it is a place where litter has already accumulated*. To help change this behavior of littering we will need to change the littered environment. To understand how this happens it is important to understand the difference between behavior and habit. A person's behavior is an action committed in response to external stimuli of environment. Behavior is a conscious act. Habits are behaviors that are done repeatedly until they become unconscious acts. Habits are hard to change because the individual is not aware of the habit.

Do this activity as part of the Great American Clean-up and receive Professional Development Credit hours

Materials

geocache box with log book, trash bags, protective gear, smart phone and or GPS unit, camera or smart phone

Vocabulary

GPS, behavior, habit, geocaching, littered site profile

I. Exploration/ Procedure

1. Brainstorm with student about why they think people litter, where they have seen litter and discuss the differences between a human behavior and a human habit.
2. Check students' prior knowledge of GPS and geocaching. Watch the GPS How it Works video and the Intro to Geocaching video.
3. Tell the students that they are going to do a research project to determine if changing the "littered site profile", the amount of litter per square yard, can change people's littering behavior at that site.
4. Have the students identify heavily littered sites within walking distance of the school. Sites must be on public land,(e.g. schools, parks, road right-of-ways). Have students record the location either by GPS location or description/address. Have students take photos of the site if possible.
5. The class should review the sites and select one site for their experiment. Have students create a rubric of the elements of an appropriate site for the experiment (public place, safe for students, visible, has a good place for hiding the geocache box).
6. After the site is selected, ask students to determine how the "litter site profile" will be measured. Volume of litter per square yard, weight of litter, or number of pieces per square yard. Students may develop their own method of measuring the "littered site profile".
7. Decide how often you will monitor the site. This will entail cleaning the site of litter and measuring the litter. How long you will run the experiment to measure behavior change, this should be several months. What will be in the geocache other than the log book?
8. Download apps, set a time for the clen-up and cache hiding. Prepare the cache.
9. Conduct the first clean-up, measure the amount of litter, and hide the cache. As a class upload the "Before" and "After" photos and setup the geocache on the Geocache.com website. Start the cache name with KAB, ex.KABnacSchool. Check out other KAB caches. On the site ask geocachers to add their photos of the site. Create a code to add clues for where the cache is hidden. Have students record the amount of litter in a spreadsheet. Record the litter amounts in the spreadsheet after each clean-up. After the last clean-up make a graph from the data.

II. Explanation/Discussion

Have students share their graphs and discuss your findings. Did your experimental treatment change littering behaviors at that site? What might have been other influences or variables that were influencing your results?

III. Elaboration/Extension

Plan a [Cache In Trash Out](#) event for your community. Share your research with other classes, post it to the school website or the city blog.

IV. Evaluation

Have students review the differences between behaviors and habits. What do they think that their site will look like in 6 months, why?

Litter Evaluation Bag

The Choices We Make

“The trash and litter of nature disappears into the ground with the passing of each year, but man’s litter has more permanence.”

John Steinbeck

Concept

Littering is an undesirable human behavior that can be changed.

Objective

Students will be able to discuss litter as a human impact on the environment

Teacher Support and Student Engagement

Time it takes for garbage to decompose in the environment: http://des.nh.gov/organization/divisions/water/wmb/coastal/trash/documents/marine_debris.pdf

Video Roadside Litter Endangers Wildlife: <http://www.dep.wv.gov/pio/VideoGallery/Pages/RoadsideLitterEndangersWildlife.aspx>

Brief

Litter is solid waste that is discarded in an inappropriate place (e.g. streets, parks, streams, etc.), or improperly stored waste which has escaped from its container or a vehicle. Litter refers to the object or item that is improperly discarded, the behavior is called littering. Behaviors can develop into habits through repetition. Behaviors can be changed. While the percent of American’s that

reported having littered in the last month was down to 15% from 50% in 1968 we still have a lot of litter. So why do people litter? In a three year research project Keep America Beautiful, Inc. found that people litter for one of three reasons. They feel it is acceptable to litter:

- ▶ In places where they feel no sense of ownership for the property;
- ▶ Where they think someone else will clean up after them;
- ▶ Where litter has already accumulated.

Materials

One set per group: lunch size paper bag, piece of glass (safety windshield glass has no sharp edges, chip bag, balloon, orange peel, disposable cup, straw, candy wrapper, beverage can, plastic bottle, paper and pen/pencil per team.

Copy per group of time it takes to decompose sheet

Vocabulary

biodegrade, litter

I. Exploration/ Procedure

1. Assemble items from the list into a bag for each team.
2. Divide the class into teams of 4-6 students. Give each group a bag. Assure them that all the items are clean and that it is safe for them to handle the items.
3. Each team should have paper and a pencil or pen. Ask the teams to empty their bags and arrange the items so that the entire team can see all the items.
4. Instruct the teams to write down all the items in the bag and then rank them from the least environmentally harmful to the most environmentally harmful. Reminder, there is no wrong answer, ALL littering is inappropriate behavior. Have students include why they ranked their items in that order.

II. Explanation/Discussion

Reminder, there is no wrong answer, ALL littering is inappropriate behavior. Have students include why they ranked their items in that order. Make a chart and record the rankings from all the teams. Turn the chart into a graph. For a discussion on the economic impact of littering go to our [Partner Lesson: CEE Why Adopt a Highway](#).

III. Elaboration/Extension

Give students a copy of the "How long it takes to decompose" sheet or have them go to the linked site and rank the items from fastest decomposing to slowest decomposing. Discuss how decomposition rates might influence environmental impact of the littered item. To participate in a cool geocaching activity and techie fun for litter awareness see KAB Lesson "[Trash & Cache](#)". For service learning opportunities go to the Leaders Guide for the Great American Cleanup.

IV. Evaluation

Have students discuss ways to change littering behaviors in their community. To develop a media campaign see KAB lesson "[Media Blast](#)".



Partner Lesson

Council for Economic Education

Why Adopt a Highway

Littering has an economic impact on communities.

<http://www.econedlink.org/lessons/index.php?lid=345&type=educator>



Community Greening

The Recycled Garden

Being Green is a Beautiful Thing

"It's not about what it is, it's about what it can become."
—Dr. Seuss, *The Lorax*

Concept

Gardens done well are by their very nature acts of recycling.

Objective

Students will research the options for recycling in the garden. Students will design and construct a school or community garden incorporating recycling materials and options into the plan.

Teacher Support and Student Engagement

[Background Composting](#)

[Background Recycling](#)

Greenhouses, storage shed, benches, walls

Inspirational site of various buildings from bottles, view the different types of plastic bottle greenhouses
<http://www.inspirationgreen.com/index.php?q=plastic-bottle-homes.html>

look for the wall design and bench designs
<http://www.inspirationgreen.com/plastic-bottle-schools.html>

photos of a construction project
<http://www.squidoo.com/plasticbottlegreenhouse>

Seed starter from bath tissue roll
<http://yougrowgirl.com/toilet-roll-seed-starter/>

Compost Bins

Nice video, good looking bins
<http://www.urbanfarmonline.com/urban-farm-videos/urban-farming-activities/build-compost-bin.aspx>

Garden Furniture

Wood pallet gardens

<http://palletfurnitureplans.com/garden/vertical-gardening-out-of-recycle-pallets/>

Benches
<http://palletfurnitureplans.com/category/pallet-bench/>

Tables
<http://palletfurnitureplans.com/category/pallet-table/>

Chairs
<http://palletfurnitureplans.com/category/pallet-chair/>

Tires
<http://www.goodshomedesign.com/decorative-pond-tires/>

Sounds for the garden
http://www.ehow.com/how_7776008_make-bells-aluminum-tanks.html

Rain Barrels
<http://www.hgtv.com/gardening/conserves-water-with-a-rain-barrel/index.html>

Articles

<http://birdsandbloomsblog.com/2012/03/31/recycle>

<http://www.backwoodshome.com/articles2/sandersg8.html>

<http://frugalliving.about.com/od/save-money-on-plants/tp/How-To-Get-Free-Seeds.htm>

Brief

Recycling comes in many forms. It can be creative and artistic, beautiful and practical and nowhere is it more engaging or diverse than in a garden.

Materials

Garden Design Elements list

Vocabulary

LEEDS, recycled, reused, repurposed

I. Exploration/ Procedure

http://www.youtube.com/watch?v=SZz58_Gz_L4

1. Use this video to engage students in a conversation about the importance of green spaces in a community. Make a list of their responses.
2. Discuss areas in the community that need greening or beautification. *If you have completed the KAB [Over the Rainbow lesson](#) review the [Rainbow now](#).*
3. Tell the students that they will be working to select a site, and design and build a garden this year.
4. Discuss the ways a garden naturally recycles (decomposition, water cycle, nitrogen cycle), and that their design should include recycling. The design should be economically and environmentally responsible.
5. Divide class into teams to research options for the garden. Use the *Garden Elements* list to assign teams to research options for various elements of the garden. Remind them that they are to look for ways to recycle or use recycled materials. The links in the Teacher support/student engagement section should get them started.

II. Explanation/Discussion

Have teams make a short presentation of their recommendations for the garden, make a list of the elements and the items recommended. Map the site where you would like to create the garden. Have teams use the map and garden element recommendations to create a garden design. Review the designs as a group and either vote to select the best design or create a composite design of the best elements from different designs.

III. Elaboration/Extension

Have students create a list of materials needed for the project. Put the materials into categories; purchase, donated new, recycled, reused or repurposed materials. Make a budget. Develop a presentation for the person or organization that will need to give permission for the project to be implemented. [Do this project as part of the KAB Great American Cleanup and get Professional Development credits.](#)

IV. Evaluation

Have students list the different types of materials or resources that were saved or diverted for a different use by their project design. Have students define what a LEEDS certification means.

Garden Design Elements

Plants	Hardscape	Water	Decorative	Workspace/ Storage	Growing Structures	Composting
	Paths	Location	Chairs	Potting Bench	Greenhouse	Bins
	Walks	Conservation	Benches	Storage	Hotbed	
	Planters	Habitat	Tables	Shed	Hoop bed	
	Fencing		Sound		Raised bed	

Partner Lesson

National Arbor Day Foundation

The Many Benefits of Trees; the How, When, Where, and Why to plant trees.

Step 1

Discover What Trees Do For You and Your Community

BASIC ACTIVITY

Classroom Activity:

- Discover the Benefits of Your Community Trees

Objectives:

Students will be able to:

- identify ways trees “work” to protect our natural resources.
- estimate the economic value of urban trees to individuals and to a community.
- describe several ways trees enhance human environments and natural ecosystems.
- recognize appropriate planting sites for urban trees in their community.

Time Recommended:

- One 60 minute class period

Materials Needed:

- Overhead transparency of page 12 (or one copy per child)
- Copy of worksheets on page 9-11, 13-15 (one per student)
- Pencil and paper
- Calculator (optional)

National Science Standard Correlation:

Students will develop an understanding of:

- populations and ecosystems
- populations, resources, and environments
- diversity and adaptations of organisms

National Social Studies Standard Correlation:

Students will be able to:

- describe how people create places that reflect cultural values and ideals as they build neighborhoods, parks, and the like.

National Math Standard Correlation:

Students will be able to:

- recognize and apply mathematics in contents outside of mathematics.

Background Information:

In the early 1900s America was still a very rural nation where people had close ties to nature. Today nearly 80 percent of the United States population lives in urban/suburban areas. Often people think of forests only as distant, vast tree-covered tracts of land. They are unconscious of the urban forest that exists in their own cities and towns. Trees play a vital role in these urban environments.

Urban forests cover close to 70 million acres of land – an area larger than our National Forests. These community trees are working trees. They not only provide beauty, shade our streets and schoolyards, create habitat and food for wildlife; they also produce oxygen, improve air quality, muffle noise, moderate the temperature, filter runoff, protect the soil, and cool the air. More and more research is showing just how essential trees are to the quality of life and environmental health in our cities and towns.

Research shows that trees help reduce stress in the work place and speed recovery of hospital patients. Trees increase land values. Houses with trees often sell faster and for more money than those without trees. Commercial retail areas are more attractive to shoppers, apartments rent more quickly, tenants stay longer, and space in a wooded setting is more valuable to sell or rent.

Studies also show that young children benefit greatly from connecting with trees and nature. A connection with nature benefits children educationally, behaviorally, and developmentally. On-going research and field-testing confirms that regular connection with the natural world helps:

- Build children’s visual-spatial skills.
- Improve children’s ability to concentrate, including children with Attention Deficit Disorder (ADD).
- Enhance children’s motor skills – such as coordination, balance, and agility.



Shade

Windbreak

Erosion control

Absorb carbon dioxide

Homes for animals

Syrup

Clean air

Connection to history

Cools the air

Reduced stress

Make Oxygen

Fruits

Beauty

Nuts

Shelter

Food for wildlife

Prevent water runoff

Medicines

Mark the changing seasons

Cities and towns benefit greatly from their urban trees. But trees within cities also have special challenges. There is not as much space for their roots to spread out and urban soils are often poor. Tall buildings can prevent trees from getting full amounts of sun. Pollution from cars, buses, and factories can affect the health of a tree and impact how well it grows. If the right tree is not planted in the right place, branches can grow and tangle in power lines creating a hazard tree. In spite of these challenges, many species of trees have adapted to urban life and grow well, providing numerous benefits to the people that live there.

It takes time, effort, and some funding to establish and maintain the urban forest, but recent studies of the urban forest have shown that city trees provide benefits to the community worth 2-3 times the cost of their planting and care. For many years trees were only valued for the wood products they could produce. Today, scientists have developed ways to measure the economic value of trees to the environment. In the following activity, students will have an opportunity to learn how trees impact the urban environment and calculate a rough estimate of a “working” tree’s value. They will explore the environmental, economic and social benefits trees bring to our cities and towns.

Instructional Sequence:

Anticipatory Set:

Put up the overhead (or pass out handouts) of the World with Trees worksheet (page 12). Ask, “Which of these two worlds would you rather live in?” As students respond, ask why they chose as they did. Record responses on the board without comment.

Continue class discussion by asking, “Why are trees important to our community?” Building off of students’ prior knowledge and information gathered from the handout/overhead, encourage students to generate a list of the products and contributions made by living trees. A possible list of responses is provided above.

“To exist as a nation, to prosper as a state, and to live as people, we must have trees.”

Theodore Roosevelt

Step 1

Discover What Trees Do For You and Your Community - BASIC ACTIVITY

BENEFITS OF TREES

Activity:

Write the words TRUE and FALSE on the chalkboard. Tell students you are going to read some “Believe it or Not” statements about trees. They need to predict if each statement is true or false. If they believe the statement is true, they should stand. If they believe the statement is false, they should remain seated. To start, read **ONLY** the bolded statements #1-10 on pages 10 & 11 out loud.

Once you have gone through all 10 statements, tell students that all were true. Trees do all these amazing things for us and the environment we live in. Write “economic benefit,” “environmental benefit,” and “social benefit” on the board. Pass out the Benefits of Trees Handout (pages 10-11) and go through the statements again with students, this time incorporating the background information and comments following each statement.

Discussion:

As each benefit is discussed, ask students if they think that particular tree benefit results in more of an:

- **Environmental benefit** – Does it help the ecosystem/environment in which people live?
- **Economic benefit** – Does it provide an opportunity for people or the community to save money by lowered costs or increased value?
- **Social benefit** – Does it improve the health or quality of life for individuals in some way?

After going through the handout, ask if planting trees in certain locations can have multiple benefits?

Tell students that even though research is proving the environmental, social, and economic benefits of trees, we’re losing urban trees every day. In some cities, as many as four trees die or are removed for each new one added. And nationwide, each day 2,400 acres of rural land is absorbed for urban use and most of the trees on that land are not preserved. Surveys indicate that about 66-100 million spaces exist along our city streets where trees could be planted. This translates to the potential to absorb 33 million more tons of CO₂ every year and at the same time save consumers \$4 billion in energy costs!

Be sure to explain that in a city, trees face numerous challenges like tight spaces, poor soils, and city pollution. It’s always important to select the right tree for the right space, but in urban areas that is especially true if a tree is to grow and thrive.

Distribute the Vocabulary/Rubrics (page 9) as well as the Community Neighborhood Worksheet and the Benefits of Your Community Trees Worksheets (pages 13-15).

NOTE: For the activity you may choose to have students work in pairs or on their own.

STUDENT DIRECTIONS: Tell students to imagine they each just received trees from the Arbor Day Foundation and are going to have an opportunity to plant them in a neighborhood that might be similar to the one where they live. Students are to draw in (plant) 8 trees in locations on the Community Neighborhood Worksheet where they feel the trees might be of the most value...to themselves, to the community – or both. Ask them to please number each tree that they plant, #1-8. Then, on the Benefits of Your Community Trees Worksheets, they should list where they planted each of their trees, and what environmental, economic, or social benefit each tree might provide in the location they selected. Remind them to make sure the number of the tree on the Community Neighborhood Worksheet corresponds to the number of the tree location described on the Benefits of Your Community Trees Worksheets.

Mention to students that it is always important to plant the right kind of tree in the right location, but for this activity they should imagine that they have already selected the appropriate tree species for each location they might select.

Give the students the following example:

If they planted Tree #1 by the stream it might have:

- an environmental benefit of holding the soil in place;
- an economic benefit of saving the city money by reduction of storm water runoff;
- and a social benefit of adding beauty to the area.

Then point out the “Tree A” example on the worksheets.

Step 1: Discover What Trees Do For You and Your Community - BASIC ACTIVITY

Then explain that they should list what benefit (social, economic or environmental) was the main reason that they selected the location for the tree that they did. When they do their tree location totals at the end of the Benefits of Your Community Trees Worksheet they may have 3 trees in one location and no trees in another – that is fine. Encourage students to refer to the Benefits of Trees Handout or the list on the board for a reminder of some of the different benefits trees provide in different locations.

Assessment - Pulling It All Together:

Allow students about 20 minutes to complete their worksheets. Then tell students they are going to jump 10 years into the future and try to determine the impact and the value of the trees they planted. Explain that they will be able to estimate the value of their community trees.

Refer students back to Benefit #10 on their Benefits of Trees Handout that says, “Nationally, the 60-plus million street trees have an average value of \$525 per tree each year.” Tell students to multiply the number of trees they planted times \$525 ($8 \times \$525 = \4200). That will give them a rough idea of the economic value from the environmental benefits provided by the trees they planted in their community. Then, on the board, calculate the total value of the trees planted by the whole class ($\#$ of students \times \$4200) to demonstrate the impact a group of people planting and caring for trees in a community can have on the economy of a community.

Tell students that if they planted 3 trees around the little house they could give themselves \$10,000 for the increased

value of their property. If the 3 trees planted around the little house were on the west and south side of the house they could give themselves an extra \$50 in energy savings.

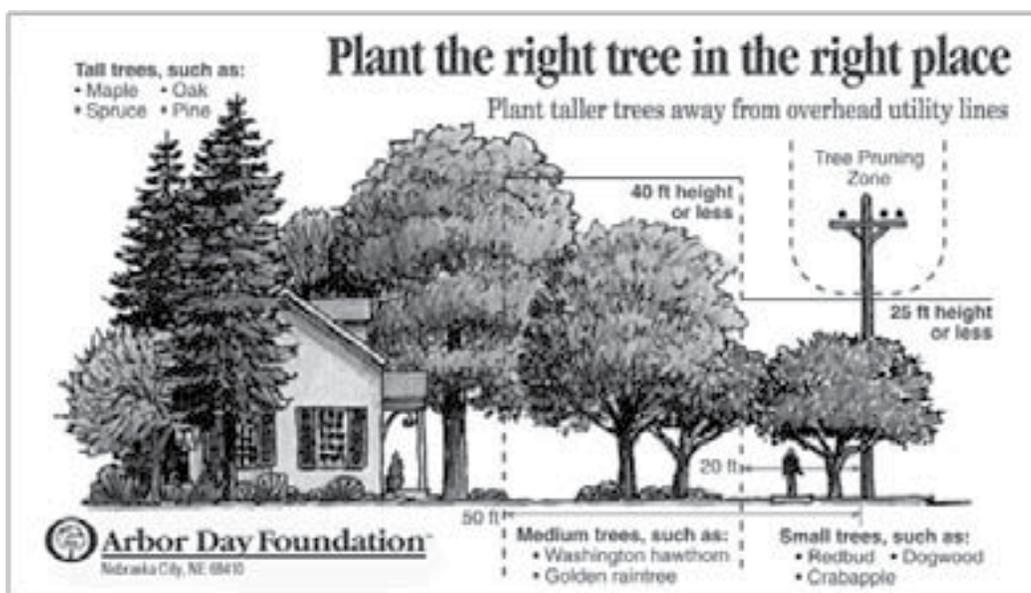
Stress to students that although part of this activity was to estimate the economic value of the trees they planted, the object is not to see who totaled up the greatest amount of money. The object of the activity is to help students recognize that trees provide benefits to our lives in many ways... some values are easily measured in terms of dollars and cents...some benefits (like the beauty of trees in a park) are subjective from one person to another and are more difficult to measure.

Post worksheets on the board so students can compare tree planting locations. Ask them to imagine each of their neighborhoods joined together, making up a large city. As time permits, allow students to share their community tree planting decisions and predict the social, environmental and economic impact of the trees they planted.

If you have an extra class period, you may wish to have students go online to research other values trees provide to communities.

Alternative Assessment:

GET OUTSIDE! If time permits, take students on a walk around the neighborhood and look at community trees. Predict what benefit each tree might provide in the location in which it's planted. Have students imagine they get to plant a single tree. Have them draw a picture or write a story about what benefits that tree might provide to them and to their community in the future.



Vocabulary and Assessment Rubric

Vocabulary

Buffer Strip – rows of trees or grasses planted along a stream or waterway to help prevent soil erosion and filter pollutants from running into the waterway.

Carbon Dioxide – A gas exhaled by animals and released from burning fossil fuels or in the process of decomposition. Trees clean the air by taking in carbon dioxide to use in photosynthesis. Often shown as CO₂.

Evergreen - A tree that has leaves all year round.

Fossil Fuels – Non-renewable fuels, like coal, oil, and natural gas, used to create energy. Once the supply of a fossil fuel has been depleted, it is gone forever.

Greenhouse gases – Gases, like carbon dioxide, that trap heat in the atmosphere.

Heat Island Effect – A term used when city temperatures run higher than those in nearby suburban and rural areas, primarily due to large areas of unshaded buildings and pavement.

Oxygen – Trees and other green plants produce oxygen, a gas needed by animals to survive. Often shown as O.

Runoff - The flow of water, from rain, snowmelt, or other sources that can carry soil or ground chemicals with it.

Shade Tree - A tree planted chiefly to provide shade from the sun. Shade trees are often deciduous trees that lose their leaves in the winter months.

Street Trees - Trees near the street, often located between the sidewalk and street, which are usually managed by the city or town.

Water Management Systems – Underground systems that direct waste water and rain water through a system of sewers and drains.

Assessment Rubric: (To be used with the Benefits of Your Community Trees Worksheets)
Pass out the rubric or put on the board at the start of the activity so students clearly understand the measured objectives.

1- 2 Points SEED LEVEL	3-5 points SEEDLING LEVEL	6-8 Points SAPLING LEVEL	9-10 points TREE LEVEL
<ul style="list-style-type: none"> • Five trees are drawn into the Community Neighborhood Worksheet. • A few planting locations are identified. • At least one benefit social, environmental, or economic is correctly identified for each tree drawn in. 	<ul style="list-style-type: none"> • More than half of the trees are drawn into the Community Neighborhood Worksheet. • Over half the planting locations are identified. • At least two benefits social, environmental, or economic are correctly identified for each tree drawn in. 	<ul style="list-style-type: none"> • All 10 trees are drawn neatly into the Community Neighborhood Worksheet. • Clear descriptions of the selected planting locations are shown. • At least one social, environmental, and economic benefit is correctly identified for each tree drawn in. • The tree totals are filled in on the Benefits of Your Community Trees Worksheet. 	<ul style="list-style-type: none"> • All 10 trees are drawn neatly into the Community Neighborhood Worksheet. • Clear descriptions of the selected planting locations are shown. • Several social, environmental, and economic benefits are correctly identified for each tree drawn in. • The tree totals are filled in on the Benefits of Your Community Trees Worksheet.

Benefits of Trees Handout

Trees provide benefits to you and to your community in a variety of ways. Here are just a few examples. As you read through this list, consider if that tree benefit is more of an environmental, economic or social benefit.

1. Trees properly planted around a home can lower air conditioning AND heating costs. TRUE. Shade trees



planted on the west and south sides of a home help shade and cool the air around the home during the summer reducing cost for air conditioning up to 30%. Evergreen trees placed on the north and west sides of a home or building block cold winter winds, reducing cost for heating by 20-30%. For example, if you have two identical houses with the only difference being one has carefully planted trees and the other does not,

the house with the trees might only spend \$70.00 a month for heating while the treeless home might have a \$100.00 heating bill. That savings also means less burning of fossil fuels (non-renewable oil, coal or gas), which is good for the environment!

2. Trees help clean the air. TRUE. Trees improve the quality of the air we breathe by capturing dust and pollution particles from dirty city air that can affect our health. These particles cling to the leaves rather than float in the air. When it rains, the dust and particles are simply washed to the ground. Trees also remove greenhouse gases, like carbon dioxide, from the air and replace it with oxygen for us to breathe.

“The best friend on earth of man is the tree. When we use the tree respectfully and economically, we have one of the greatest resources on earth.”

Frank Lloyd Wright

3. Healthy, mature trees around a house make the property more valuable. TRUE. Trees can add an average of 10–15% to a property’s value. For example, a home or apartment building valued at \$100,000 might sell for \$110,000 (\$10,000 more!) if it has trees around it. Tree planting is one of the best investments a person can make in their home. And in business areas, too. Business areas with trees are more attractive to shoppers.



4. Research studies suggest that housing areas with trees and other green plants have less violence and crime. TRUE. Living in an area with trees helps reduce stresses that can be associated with living in a big city. Less stress can ease tensions that sometimes lead to violence. Even a small number of trees and other green plants in an area were associated with lower crime rates. Apartment buildings that had lots of trees and plants had 52% fewer total crimes than apartment buildings with few or no trees or plants.



Benefits of Trees Handout

5. Hospital patients have been shown to recover from surgery more quickly and require less pain medication when their room had a window that provided a view of trees. TRUE. A study found that exposure to trees and nature lowered signs of stress... like heart rate, blood pressure, and muscle tension.



6. Trees help slow the force of rain water, which helps control storm runoff. This results in improved water quality, protected soil, and money savings. TRUE. The canopy (leafy top) of a tree softens and slows the force of raindrops. This gives water more time to absorb into the ground rather than eroding the soil and running off into storm sewers. Large water management systems are expensive. When trees are planted, smaller drainage systems can be used, saving money for a community and improving the environment.

7. Trees help prevent soil erosion, flooding, and landslides. TRUE. Tree roots hold soil in place and increase the ability of water to soak into the soil. Trees planted as buffer strips along streams help prevent flooding ...and even filter out chemicals that might wash into the stream.



8. The overall cooling effect of a healthy, mature tree is equivalent to ten room-sized air conditioners operating 20 hours a day. TRUE – Amazing! Water from a tree's leaves evaporates in the hot weather. The evaporated moisture cools the air around the tree. Since cool air is heavier than hot air, this cool air moves toward the ground making us feel cooler. Cities, with stretches of concrete streets, sidewalks and parking lots, are sometimes referred to as "heat islands" that are 5-9 degrees hotter than surrounding areas. Planting trees in cities helps alleviate the heat island effect – which saves both energy and money.

9. Getting outside and connecting with trees and nature has been shown to improve children's concentration and attention span. TRUE. When children spend time in nature-rich spaces their ability to concentrate improves. Even small areas of green space, with a few trees and plants, can make a difference for children.



10. The city of New York determined that for every dollar spent on trees the city receives \$5.60 back in benefits the trees provide. TRUE. Think of all the things a tree does for the environment. If a city had to find other ways to handle storm water, clean the air, remove carbon dioxide generated by industry, reduce energy costs and beautify the community it would be very costly. All the things a tree does naturally are of great benefit to a city or town.

It has been estimated that the nation's 60 million street trees (city-owned trees between the sidewalk and street) have an average value of \$525 per tree each year.

A World With Trees Worksheet

A World Without Trees



Silty, flood-prone rivers

Sun baked cities

Rapid runoff

Eroded farmland



Natural streams

Shaded homes and streets

Forested slopes for recreation

Productive farmland

A World With Trees

Benefits of Your Community Trees Worksheet

DIRECTIONS: You have been given 8 trees to plant in your community. On the *Community Neighborhood Worksheet* you should plant (draw in) 8 trees in areas where you feel they will provide the most benefit – to you, to the community, or both. Number each tree that you plant. Then, on this worksheet, list where you planted each of your trees and what environmental, economic, or social benefit each tree might provide in the location you selected. You may refer to the Benefits of Trees Handout for ideas.

Environmental benefit: Does it benefit the ecosystem/environment in which people live?

Economic benefit: Does it help people, or their town, save money by lowering expenses or increasing property value?

Social benefit: Does it improve the health or quality of life for individuals in some way?

EXAMPLE

Tree A Planting Location On the North side of a house

Why did you select this location for this tree? The tree will help protect the house from cold winter winds



What environmental, economic or social benefits might you get from this tree? Saving money for heating would be an economic benefit. Using less energy for heating would be a benefit for the environment.

Which benefit was most important to you when planting this particular tree? Economic

NAME _____

Tree 1 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

Tree 2 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

Tree 3 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

Benefits of Your Community Trees Worksheet (cont.)

Tree 4 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

Tree 5 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

Tree 6 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

Tree 7 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

Tree 8 Planting Location _____



Why did you select this location for this tree? _____

What environmental, economic or social benefits might you get from this tree? _____

Which benefit was most important to you when planting this particular tree? _____

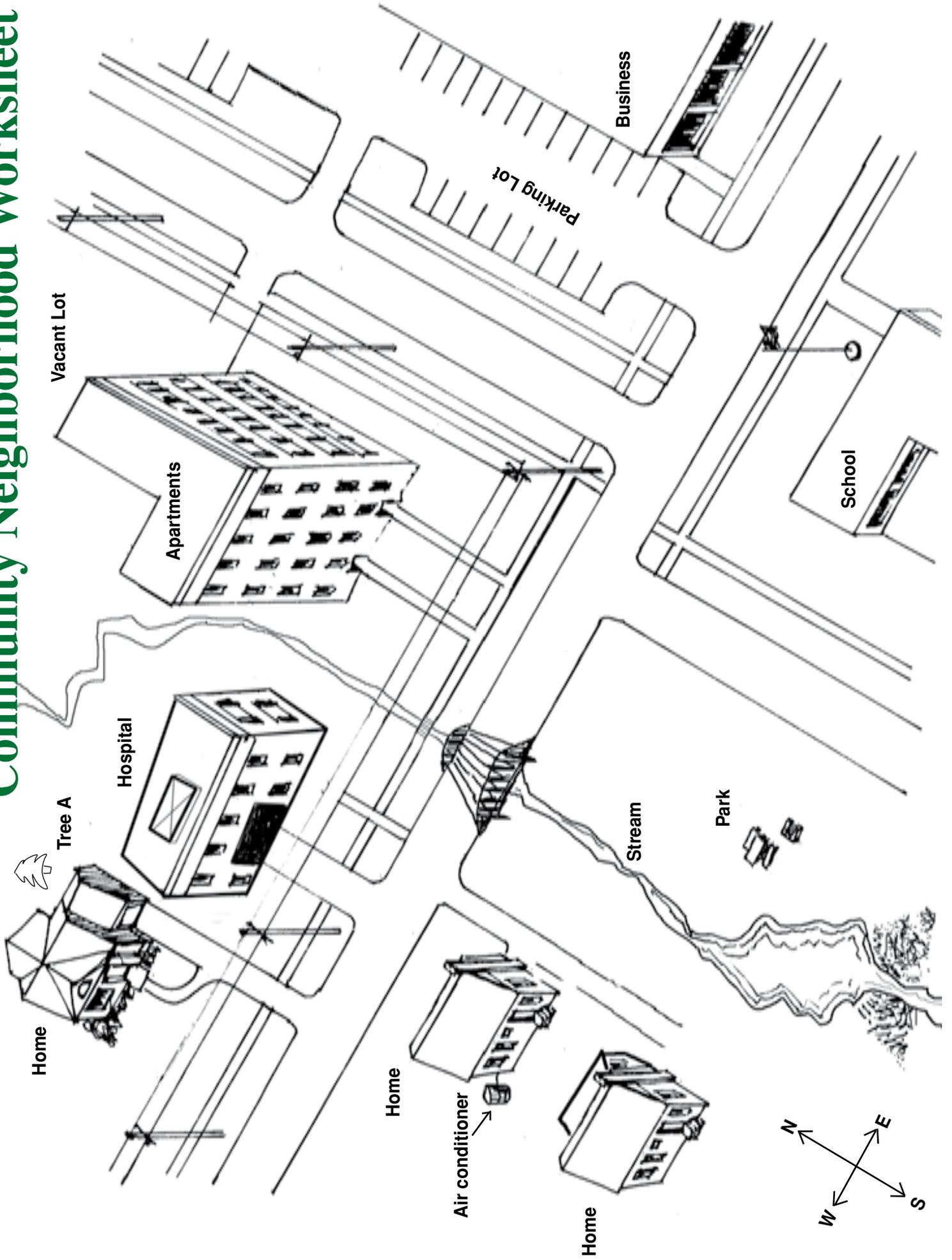
Totals: How many trees did you plant in these locations?

_____ by the stream, # _____ by the school, # _____ in the park, # _____ by a home, # _____ next to the hospital,

_____ shading a parking lot, # _____ by the apartments, # _____ by the business district, # _____ in the vacant lot

Which benefit (environmental, economic or social) did you consider most often when selecting locations for planting your trees? _____

Community Neighborhood Worksheet



Step 1

Discover What Trees Do For You & Your Community

EXTENSION ACTIVITY

Classroom Activity:

- **Tree-mendous Community Tree Contest**

Objectives:

Students will be able to:

- Learn techniques used by professionals to measure champion trees.
- Practice tree identification skills.
- Incorporate math skills.
- Recognize special trees in their community.

Time Recommended:

- Two 60 minute class periods

Materials Needed:

- Leaf samples
- Measuring tape
- Yardstick
- Tree pictures from old calendars or magazines or leaf samples from broadleaf and conifers
- Pencil and Paper
- Measuring Up a Champ Guidelines (page 20)
- Optional: Tree Identification Books

National Science Education Standards

Correlation:

Students will develop an understanding of:

- organisms
- populations and ecosystems
- abilities necessary to do scientific inquiry

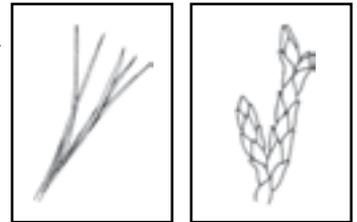
Anticipatory Set:

Tell the students they are going to take part in a “Tree-mendous Trees” contest to find the biggest trees in town or in the neighborhood community. Ask students to think about the trees they see on their way to school. Where do they see the biggest trees...in yards, in parks, around the school? Record their comments. Then ask them how many different kinds of trees they see.

Help students understand that not all tree species grow to be the same height. Some trees, like the Redwoods in California, are giants towering more than 250 feet above the forest floor while a flowering dogwood may only reach a height of 35 feet. Both could be considered champions if they were the largest of their kind.

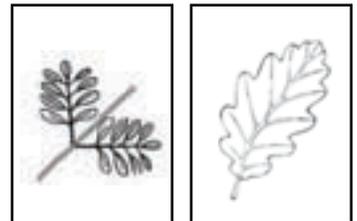
Explain to students that trees are divided into two main groups: conifer and broadleaf.

Conifers are trees with cones that have needle-like or scale-like (awl-shaped) leaves. Most conifers are evergreen since they do not lose all their leaves at once. Pines, firs, cedars and spruces are conifers.



Conifer

Broadleaf trees are trees with leaves that are thin and flat. Leaves are generally shed annually. They bear flowers, fruits or nuts. Oaks, maples, birches, and sycamores are just a few of the many different kinds of broadleaf trees. Broadleaf trees are sometimes referred to as deciduous trees. In warm climates, some broadleaf trees, like magnolias, do not shed all their leaves at the same time so they appear to remain evergreen.



Broadleaf

Background Information:

Holding a community tree contest is a great way to get children interested in the trees in their neighborhoods. Students will learn some of the techniques used to measure champion trees and have the opportunity to identify some community trees.

“He who plants a tree loves others besides himself.”

Thomas Fuller

For visual learners, it is helpful to have a leaf sample from a conifer with needle-like leaves, a conifer with scale-like leaves, and a broadleaf tree. An inexpensive acrylic picture frame works well to keep brittle leaf samples protected and in place while still offering students a clear view of actual leaves.

Cut tree pictures from old calendars or magazines and have the students group them as conifer or broadleaf. Take a walk around the school grounds and have the students distinguish between conifer and broadleaf trees, then have the students calculate the ratio of conifers to broadleaf trees in the area visited.

Activity:

Ask students to think again about trees that they pass en route to school.

- Are there more conifers or broadleaf trees?
- Can any generalizations be made about where broadleaf and conifers are planted? (Often conifers are planted in parks or large, green spaces because of their pyramidal shape.)
- Where might you go to look for the biggest broadleaf trees? Where might you find the biggest conifers?

From the comments generated by the students, determine some of the best areas in the community in which to find large, mature trees.

Determine how large an area of the community is feasible to include in the contest. Is transportation available to your class or do you need to stay within walking distance of the school? Are there many sites in the community with large trees, or just a few? Designate an area and set the boundaries.

Your class may choose to simply search for the biggest tree in the designated area. They may wish to find the biggest broadleaf and the biggest conifer. Students might learn to identify a particular tree species, perhaps their state tree, and hunt for this kind in the community. In all cases, students should be able to make the distinction between conifer and broadleaf trees and understand how to properly measure a tree.

Measuring Trees

Foresters have a special formula to measure trees. This formula includes the tree's height, circumference, and crown spread. A tree receives one point for every foot of height, one point for every inch of circumference (taken at 4 ½ feet), and one-fourth of a point for every foot of average crown spread.

Explain to the students that they are going to practice measuring trees before looking for a "Tree-mendous Tree" winner. Divide students into groups of three or four. Each group will need measuring tape, yardstick, and a pencil and paper to record their findings.

It may be helpful to assign roles to each student within a group. Group jobs include:

Recorder - records measurements and tallies points

Investigator - takes the measurements

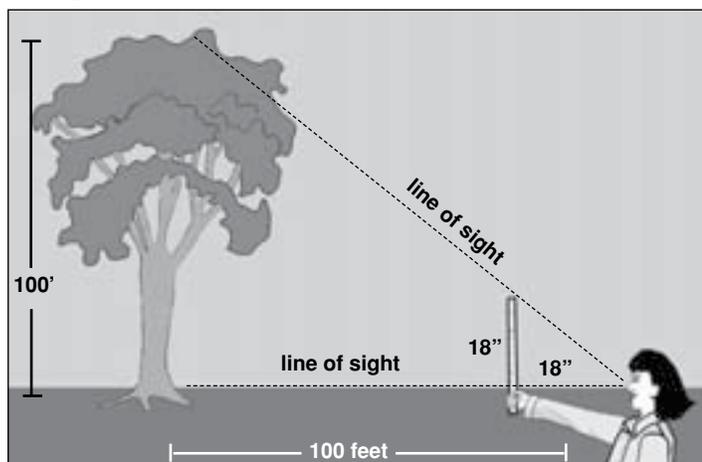
Manager - assists the investigator to make sure measurements are accurate and is responsible for the measuring tape and yard stick

Take students to a nearby area with enough trees to allow each team to measure a tree. Explain that they are measuring these trees for practice and later they will search for the "Tree-mendous Trees" in their community.

Students profit from learning how to actually identify a tree by its leaves, bark, shape, fruit, flowers, and buds through the use of a dichotomous key. A kid-friendly tree identification guide, *What Tree Is That?* is available from the Arbor Day Foundation if you wish to expand your tree identification study. Visit arborday.org to learn more.



Height



Example: If the distance from your eye to your fist is 18" make sure the distance from the top of your fist to the top of the ruler is also 18". Be sure to hold your fist directly out at eye level and keep the ruler straight up and down.

STEP 1 - Students should stand on level ground to take measurements.

STEP 2 - The student investigator extends his/her arm out straight so that the top of his/her fist is at eye level. Carefully using the yardstick, the manager makes sure the top of the investigator's fist is at eye level and then measures the distance from the investigator's fist to the investigator's eye. The recorder writes down this measurement.

STEP 3 - The investigator directly faces the tree to be measured holding the yardstick vertically in his/her extended fist so that the distance from the top of his/her fist to the top of the yardstick is the same eye-to-fist distance measured in the previous step. The manager checks the measurement then makes sure the investigator's arm is straight out, fist at eye level with the yardstick straight up and down.

STEP 4 - The investigator slowly (and carefully) walks backward away from the tree until he/she can see the base of the tree by looking over the top of the fist and the top of the tree by looking over the top of the yardstick.

STEP 5 - The manager measures the distance, in feet, from the investigator to the tree. This distance is the height of the tree.

STEP 6 - The recorder writes down the height measurement and gives the tree one point for every foot of height.

Crown Spread

The crown spread of a tree is the distance its branches spread away from its trunk. The crown spread is calculated by measuring the distance of the widest spread and the distance of the narrowest spread. These two figures are then added together and divided by two to get an average.

A tree receives $\frac{1}{4}$ (.25) of a point for every foot of the average crown spread. Follow these steps to measure crown spread: (Note: For a conifer with branches low to the ground stand next to, rather than under, the branch tip.)

STEP 1 - The investigator finds the branch that sticks out the farthest from the trunk and stands directly under or just next to its tip.

STEP 2 - The recorder goes to the opposite side of the tree and stands under or just next to the tip of the branch extending farthest out on that side.

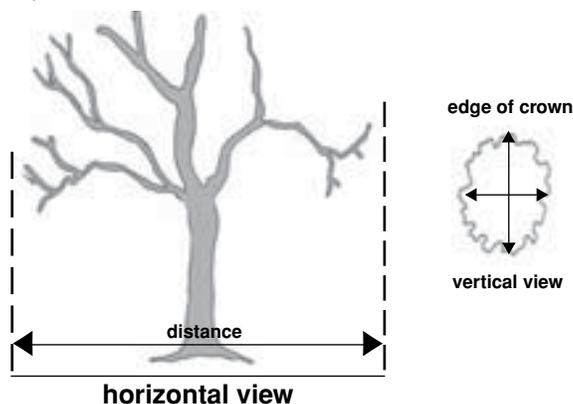
STEP 3 - The manager measures the distance in feet between the investigator and the recorder. The recorder records this number. This distance is the widest point of the crown spread.

STEP 4 - Next the investigator finds the branch nearest the trunk of the tree and stands directly under or just next to its tip.

STEP 5 - The recorder goes to the opposite side of the tree and stands under or just next to the tip of the branch closest to the trunk on that side.

STEP 6 - The manager measures the distance in feet between the investigator and the recorder. The recorder records this number. This distance is the narrowest point of the crown spread.

STEP 7 - The recorder adds the two distances together and divides by two to get an average crown spread. The recorder then awards the tree $\frac{1}{4}$ of a point for every foot of average crown spread or the students may divide the average crown spread by 4.



Circumference

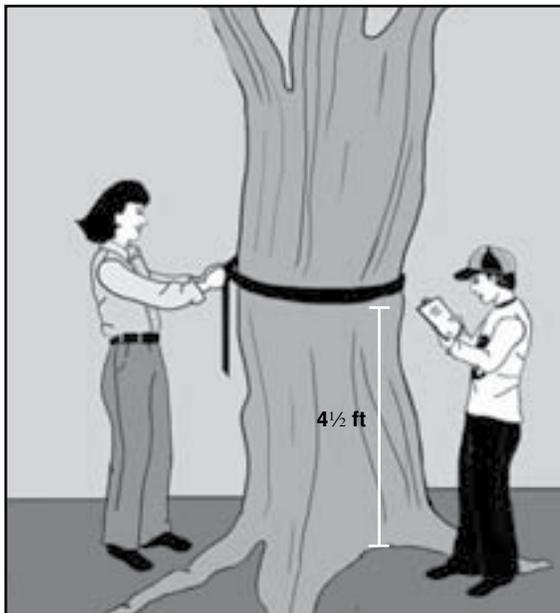
The circumference of a tree is the distance around its trunk. The circumference is measured 4 ½ feet from the ground. If the tree forks or if there are branches at the 4 ½ foot mark, the circumference is measured at the narrowest point below the 4 ½ foot level. Follow these steps to measure circumference:

STEP 1 - The investigator holds one end of the tape against the tree trunk at a measured point 4 ½ feet above the ground.

STEP 2 - The manager wraps the tape around the trunk until it reaches the starting point.

STEP 3 - The investigator reads off the measurement in inches. This is the circumference of the tree.

STEP 4 - The recorder writes down the circumference and gives the tree one point for every inch of distance around the trunk.



Measuring Up a Winner

Before starting the “Tree-mendous Trees” contest:

- Review conifer and broadleaf distinctions.
- Make sure students understand how to correctly measure a tree.

- Inform the community of the project so people will not be surprised to see the kids in their yards.
- Ask for parental volunteers to accompany the students.
- Have students create a form for the student recorders to use in their record keeping. The form should include the formula for measuring tree size and room for students to describe the location of the tree. If measuring trees in neighborhood yards, the house address can be recorded. If measuring trees in parks, a brief description of each tree’s location along with some distinguishing characteristics of each tree works well. In all cases, students should differentiate whether the tree is a conifer or broadleaf.
- Ensure safety – make sure students recognize poison ivy.

When you are ready to begin, give each group a recording sheet and the Measuring a Champ Guidelines form. This handout will help students, but you will still need to introduce and support them in the measurement process. Make sure they have something firm to write on and pencils to record their results. Check with each group manager to see that they have a tape measure and yard stick.

Establish an organized system for groups to explore the designated area or community. When students return to the classroom, have each group reporter report their findings to the class and compile results.

Have students put together a list of the community’s biggest trees. Interested students may wish to do research to learn more about winning tree species and share their results with the class.

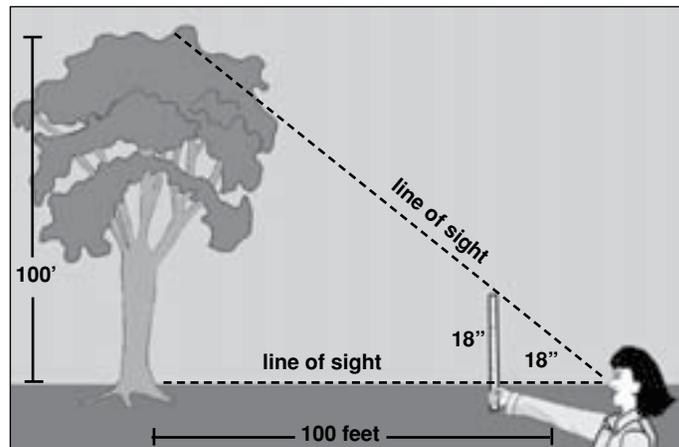
After determining the “Tree-mendous Trees” contest winner(s), your class may wish to present an award certificate to the owner of the tree if it is on private property. Or, make a presentation to the mayor or city council if the tree is on public property. Announce the tree winners on Arbor Day. Include a visit to the winning tree(s) as part of your school’s Arbor Day celebration.

Authentic Assessment: Demonstration of proficiency in tree measurement skills.

MEASURING UP A CHAMP GUIDELINES

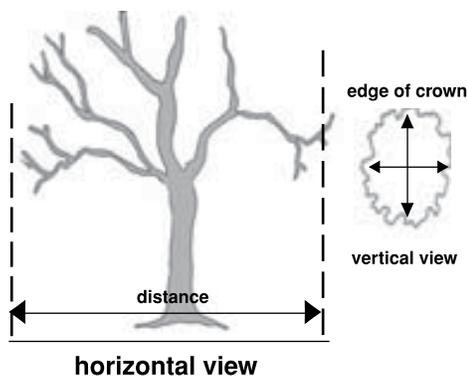
Height: The height of a tree is measured from the top of the tree to the ground. Follow these steps to measure tree height:

1. **Team**, stand on level ground to take measurements.
2. **Investigator**, extend your arm out straight so that the top of your fist is at eye level. **Manager**, make sure the top of the investigator's fist is at eye level and then measure the eye-to-fist distance. **Recorder**, write down that measurement.
3. **Investigator**, directly face the tree holding the yardstick vertically in your fist so that the distance from the top of your fist to the top of the yardstick is the same eye-to-fist distance measured in the previous step. **Team** members, help make sure the investigator's arm is straight out, fist at eye level with the yardstick straight up and down.
4. **Investigator**, walk slowly and carefully backwards away from the tree until you can see the base of the tree by looking over the top of your fist and the very top of the tree by looking over the top of the yardstick.
5. **Manager**, measure the distance, in feet, from the investigator to the tree. This distance is the height of the tree. **Recorder**, write down the height measurement. Give the tree one point for every foot of height.



Crown Spread: The crown spread of a tree is the distance its branches spread away from its trunk. The crown spread is calculated by measuring the distance of the widest spread and the distance of the narrowest spread. These two figures are then added together and divided by two to get an average. A tree receives 1/4 of a point for every foot of the average crown spread. Follow these steps to measure crown spread:

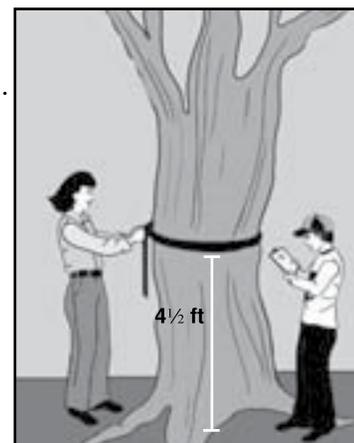
1. **Investigator**, find the branch that sticks out the farthest from the trunk and stand directly under or just next to its tip.
2. **Recorder**, go to the opposite side of the tree and stand under or just next to the tip of the branch extending farthest out on that side.
3. **Manager**, measure the distance in feet between the investigator and the recorder. **Recorder**, write down this number. This distance is the widest point of the crown spread.
4. Next, **Investigator**, find the branch nearest the trunk of the tree and stand directly under or just next to its tip.
5. **Recorder**, go to the opposite side of the tree and stand under or just next to the tip closest to the trunk on that side.
6. **Manager**, with tape measure, measure the distance in feet between the investigator and the recorder. **Recorder**, write down this number. This distance is the narrowest point of the crown spread. **Recorder**, add the two distances together and divide by two to get an average crown spread. Then award the tree 1/4 of a point for every foot of average crown spread.



Circumference: The circumference of a tree is the distance around its trunk. The circumference is measured 4 1/2 feet from the ground. If the tree forks or if there are branches at the 4 1/2 foot mark, the circumference is measured at the narrowest point below the 4 1/2 foot level. Follow these steps to measure circumference:

1. **Investigator**, hold one end of the tape against the tree trunk at a measured point 4 1/2 feet above the ground.
2. **Manager**, wrap the tape around the trunk until it reaches the starting point.
3. **Investigator**, read off the measurement in inches. This is the circumference of the tree.
4. **Recorder**, write down the circumference and give the tree one point for every inch.

TOTALS Height _____ Crown Spread _____ Circumference _____



Partner Lesson

Tree Trails (Texas A&M Forest Service)

This module guides you through the creation of a tree trail, measuring, identifying, and mapping your trees. Includes a service learning component.

(<http://texasforestservicetamu.edu/main/article.aspx?id=17910>)





Waste Management

Advertise Our Attitudes

Environmental Marketing

“Many a small thing has been made large by the right kind of advertising.”

Mark Twain

Concept

Utilizing mass marketing and multimedia techniques to promote awareness of solid waste management through source reduction

Objectives

Students will be able to plan and implement a source reduction campaign using available technology.

Teacher Support and Student Engagement

Free Emoticon Maker: Turn photos into emoticons or icons <http://www.sherv.net/emoticon-maker.html>

[Background Recycling](#)

[Background Garbage Basics](#)

Poll Everywhere: A free real time survey tool for cell phones, tablets, and computers

<http://www.polleverywhere.com>

Materials

Poster Board

Computer

Cameras

Crayons and/or Markers

Writing Materials

Vocabulary

Source Reduction, mass media

Background

There are three main components to a marketing plan:

The Message

The Target Audience

The Promotion Mix

The whole class can work to develop a marketing plan, or the class could be broken up into several small groups each to develop a plan. Provide students with the information about the marketing plan components below.

The message must catch the audience's attention, otherwise it will be ignored and therefore be ineffective. Students should create a catchy slogan that will convey the source reduction message and attract attention. Encourage the students to be creative.

The target audience is the people for whom the message is meant. It must be identified in a successful promotional campaign. Each campaign usually identifies several very specific target audiences. For example, adults who purchase coffee in disposable cups and students who use disposable batteries could be two target audiences. Defining target audiences as specifically as possible is important because it determines the content and style of the message. The message and the target audience go hand in hand.

The promotion mix defines the medium used to convey the message to the target audience. The choices are advertising, publicity, personal selling, and sales promotion. Any combination of these will work:

Advertising is a paid message conveyed through a mass medium, such as TV, radio, newspaper, handbills, direct mail, or outdoor signs. Students may not have the funds to pay for this type of advertising, but they can produce their own “home-grown” version of such things as handbills and outdoor signs. Consider adding Facebook, Twitter, or other social media sites as outlets.

Publicity is a message conveyed through a mass medium in the form of a news story. Publicity is free. Students could approach local newspaper and radio stations about their project and ask them to do a story.

Personal selling is conveying the message through face-to-face communication, which can be very effective. Students may want to prepare a short presentation (make it interesting) to give to the other classes.

Sales promotions are things such as contests, special giveaways, coupons, etc. Students could work with a local fast-food restaurant to give away free drink coupons to students who have kept their schoolyard litter-free during the special promotion period.

I. Exploration/Procedure

Ask students to define **source reduction** and give examples they have seen or heard. Introduce the term *advertising campaign* and ask students to explain what it means. In the hierarchy of waste management, source reduction is at the top of the pyramid. Tell the class that they will be developing and implementing a waste management campaign based on source reduction and waste reduction awareness.

Before an effective campaign is developed, the waste problem needs assessment. As their first task, students must determine where waste develops and which ones source reduction can address. A great assessment tool “Waste and Recycling” can be found at: <https://www.plt.org/project-learning-tree-greenschools-investigations>

After assessing the problem, the next step is to devise a marketing plan. In the business world, marketing plans market or promote a product. In the case of a source reduction campaign, a “social” marketing plan can “sell” a message or idea (for example, Stop Junk Mail). Many non-business organizations market their ideas every day. Ask students to name some of these organizations and their messages. Ask students to describe what makes social marketing special and/or different from traditional marketing efforts.

II. Explanation/Discussion

Provide ample time for students to consider all of the possibilities and arrive at a workable plan. Try to stress the “fun” factor throughout the planning stage. Help students set a timetable for implementing the plan(s).

Developing and implementing a marketing plan is a long-term project, but it is a very valuable exercise in creativity as well as a wonderful civic project.

Rewarding appropriate behavior can be a very effective component of a litter prevention plan. Have students design a system to recognize individuals who have shown creative ways to reduce waste.

III. Elaboration/Extension

Students can create videos and other multimedia components for use on websites and the schools video system.

Develop and conduct an online survey about individual purchasing behaviors. Create an “attitude” survey that helps to identify why people purchase disposable products. What is the most common reason? Use www.surveymonkey.com to create a unique survey or go mobile with Poll Everywhere.

IV. Evaluate

Have students add photos to an Instagram project showing examples of source reduction

V. Enrichment

Have students promote source reduction by creating a source reduction emoticon or icon.

Have students create a public service announcement to post on the school website or Facebook page.

Create a Tweet to start the conversation about source reduction.

Links Library

Ad Council public service campaigns

<http://www.adcouncil.org>

Crisis In Center City

Simulation of Community Waste Management

“The job of every citizen is to keep his mouth open.”

Gunter Grass

Concept

Using simulation as a culminating activity to synthesize information regarding local waste management

Objectives

Students will be able to 1) discuss local issues and examine facts regarding waste management, 2) make decisions based upon information given and the roles played, and 3) examine the consequences of decisions and actions taken.

Teacher Support and Student Engagement

Link to Waste to Energy Video

<https://www.youtube.com/watch?v=lmtOuAed5nM&list=PLAgzc2qnfFvoBnBqwc5BhZsil7XFeshds>

Link to How does a MRF work

<https://www.youtube.com/watch?v=7CFE5tD1CCI>

New High Tech MRF

<https://www.youtube.com/watch?v=0MeAUxSduUY>

Brief

A simulation is an enactment which gives the appearance or effect of a real-life situation. This activity is a simplification and partial representation of an actual experience.

During a simulation activity facts are learned in a meaningful way because information must be organized and used rather than memorized.

The teacher becomes a facilitator of learning, and discussion and evaluation of the enactment become valuable learning experiences.

In this simulation, each student assumes a role in a representative community and responds to a crisis in waste management. Students participate in gathering information, making decisions based on that information, and examining the consequences of their decisions. Through this exercise students experience the roles of government and the impacts of citizen involvement in community government. As the director of the simulation, the teacher will: (a) plan the length of time for each component; (b) assign roles to students, and assemble resource materials such as student pages and role descriptions. The teacher as facilitator will ensure a well-paced progression through the activity.

Materials

[Student handouts: Assessment rubric](#)

[Center City](#)

[Crisis in Center City student page](#)

[Student Role descriptions](#)

[Solution worksheets](#)

[Fast Facts sheets](#)

Vocabulary

simulation, landfill, MRF, Waste to Energy, incinerator, source reduction, composting, recycling

I. Exploration/ Procedure

Explain to the students that although it is important to be aware of the problems associated with waste, it is also important to understand that people perceive the problem from different points of view and that every citizen has the right to present his or her view point in the decision making process. To help students understand both of these concepts, they will take part in a simulation of a crisis regarding waste disposal in a small community. The focus should be on the process involved, not right or wrong answers. Give the students the overview of the activity.

1. Each student will be assigned a role.
2. Students will participate in the decision-making process based on the information provided, their group's research, and their roles in the community.
3. The activity will require 2 or 3 class periods.
4. Distribute copies of the student sheets "Crisis in Center City Overview".
5. Tell the students they have 10 minutes to read the overview and list some possible solutions to the problem.
6. Ask students to share their lists, record their suggestions on the board. Do not evaluate the answers, this is an exercise to prepare students for their roles.
7. Assign roles or have students select their roles. Distribute "Role Descriptions". Five students will assume roles of the special commission members: Mayor, Member City Council, County Governing Board, Executive Judge, and Citizen- at- Large.
8. The remaining students will assume roles and find the team members with whom they share a common solution. The letters on the role cards indicate the solution of the character named on the card. There are seven solution teams;
 - (RS) Restrict Services and (SR) Source Reduction
 - (MRF) Materials Recovery Facility
 - (C) Composting
 - (WTE) Waste-to-Energy
 - (LF) Landfill
 - (ZWA) Zero Waste Alliance
9. Give each team a copy of the "KAB Fast Facts" background sheet that relates to their solution, provide the ZWA and Special Commission Members with a copy of all the Fast Facts sheets.
10. Provide each student with a copy of the solutions work page.

Preparing for the simulation:

1. Students should dress for their role (at least one key item) and make and wear a name badge.
2. Provide the students with the date of the "Open Meeting" presentations of their solution.
3. Each team will make a 6-8 minute presentation of their solution. It should include: a clear statement of their position, supported with facts and the impact on the problem. Each member of the team must participate in the presentation.
4. Provide a sign-up sheet to determine the order of the presentations.

City/County Special Commission on Waste Management Team responsibilities;

While teams plan and research their presentations the special commission members will meet to create a rubric with which to assess the solutions presented. Review the problem and the criteria for best solving the solution. For example, can the solution work in time to be of significant impact, what are the financial costs, what are the impacts on citizens and the environment? You may also want to have them develop a chart to record presentation facts for review later.

Open Meeting & Presentations

1. Have the Mayor open the meeting by reading the statement in his/her role description.
2. Remind each team to make notes of the presentations for use in the discussion after the Commission hands down their decision about which solution they are going to implement.
3. After the presentation are complete the Commission will have 15 minutes to make a decision by majority vote. They must include in their decision statement the facts and impacts that influenced their decision.
4. While the Commission is making their decision, teams should be creating an objection to any decision that is not their solution. Allow 10 minutes for objections, then have the Commission vote to revise or implement their decision.

II. Explanation/Discussion

Ask the students if the Commission's selection criteria was comprehensive? What else should have been included? Were presentation to the Commission realistic? What groups, if any, were not represented in the process?

III. Elaboration/Extension

Were teams able to present all the information that would need to be considered in a real life situation? Review the Center City Public Works Timeline for a proposed landfill document. What are some of the reports that might need to be done with the proposed solution?

IV. Evaluation

Have students use their notes on the presentations and the scoring rubric developed by the "Special Commission" to score all the presentations. What was the class consensus? You may want to provide students with the opportunity to use the individual scoring rubric to score their team member and themselves.

Center City - Public Works

Timeline for the Proposed Center City landfill

August 2015	Approval to prepare pre-applications for three potential landfill areas within the Center City Extraterritorial Zone (ET)
September - October 2015	Request and receive United States Department of Agriculture (USDA) input regarding landfill/airport siting issues
September - November 2015	Prepare and submit pre-applications to the State Department of Health
November - December 2015	State Department of Health review of and approval/denial of pre-applications
December 2015 - January 2016	Select proposed landfill site
January - March 2016	Purchase site option/address local zoning
March - April 2016	Prepare and submit sub-surface investigation work plan to State Department of Health
April - May 2016	State Department of Health review and approval of work plan
May - September 2016	Perform subsurface investigation (including soil survey), prepare report, and submit all to State Department of Health
June - July 2016	Prepare landfill design criteria report
June - September 2016	Prepare landfill permit application and submit to State Department of Health
September - December 2016	State Department of Health review of application
December 2016 - February 2017	Provide responses to comments from State Department of Health
February 2017	Receive solid waste management permit
January - March 2017	Prepare initial facilities and initial Landfill cell construction documents and bid
April 2017	Award construction contract for initial facilities and initial cell construction
April - October 2017	Complete initial facilities and initial cell construction
November 2017	Begin Landfill operations

Crisis in Center City Overview

Read the background information for Center City and then list some ways in which the people of the community might handle the problem.

The Public Works Manager for Center City has projected that at current use levels the city landfill will reach its capacity and close in 10 years.

Background Information

Approximately 30,000 people live in Pretty Good County:

15,000 live in Center City

1,800 live in Hometown

1,200 live in Smalltown; and

12,000 live outside cities in the county.

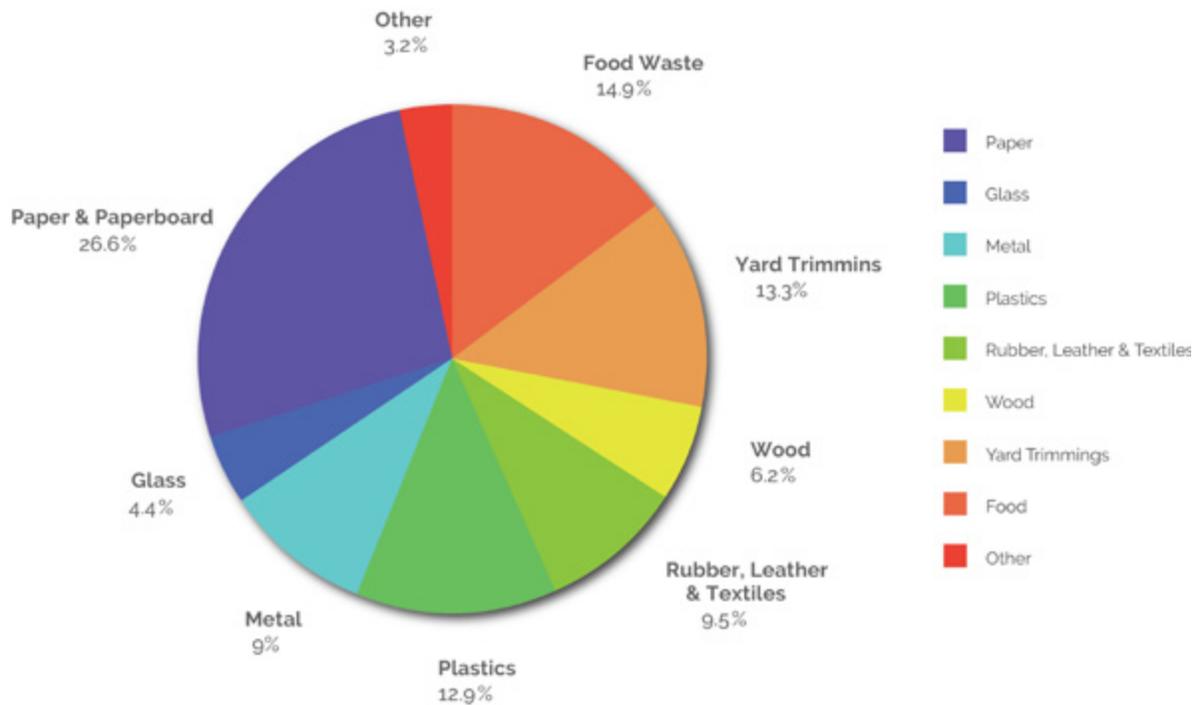
The landfill is owned by Center City and provides services to residents of the city. The residents of the county outside Center City are provided waste disposal services by an independent contractor, Pretty Good Garbage Co., owned by Randy Hauler. Mr. Hauler has a contract to use the City landfill as his disposal site.

The City plans to annex both Hometown and Smalltown. Because of the amount of time for a bond election to raise funds for landfill expansion and the time for permitting and construction the City needs to decide now to expand the landfill or implement other options to extend the life of the landfill. It is time to take the Center City waste disposal problem to the people. The people and leaders of Center City must make some important decisions regarding short- and long-term solutions to the problem of waste management. For years to come, people will be living with the consequences of the decisions made today.

Record below your first response to this situation by listing some ways in which the people might handle the problem.

The citizens of Pretty Good County are typical of the nation in general, generating 4.40 pounds of waste per person per day. The community generates 132,000 pounds of trash per day. The composition of the MSW generated by the citizens of Pretty Good County matches that in the pie chart produced by the EPA for MSW generated in the United States.

Total MSW Generation (by material), 2014
258 Million Tons



Role Descriptions

Special Commission Members

Samantha Leader, *Mayor of Center City*

The Mayor is the chief-elected administrative official of the city.

This is your first term in office and you want to do an especially noteworthy job. You want to handle this crisis in such a way that the people in your city will have enough confidence in your leadership abilities to re-elect you in the upcoming election. You would even like to be governor of the State someday. Your immediate responsibilities are to:

1. Hold a news conference to inform the citizens of the current crisis and what you plan to do about it. At the news conference you will read aloud the following statement:

"I have been notified by the Center City Public Works Manager that we must act now to implement actions to significantly extend the life span of our landfill or begin the funding, permitting, and construction of a new landfill in order to continue to provide waste management services to the residents of Center City.

This is a serious problem, not easily solved. As head of the newly formed City/County Special Commission on Waste Management, I am calling a meeting, which will be open to the public, so that citizens can present their options regarding this crisis. The commission will then make a recommendation to city and county officials for ratification. We are seeking to resolve this matter in the best interest of all the citizens of our community."

2. Preside over the Open Meeting.
 - a. Call the meeting to order
 - b. Permit citizens to speak in the order in which they are listed in the sign-up sheet.
 - c. Appoint a timekeeper to limit each group to six minutes.
 - d. Provide a five-minute period at the end of the meeting for questions from the members of the Special Commission.
 - e. Lead decision and matrix for decision.

E.Z. Goahen, *Member, County Governing Board*

The governing board is a group of elected county residents that manages the affairs of the county.

You are usually an active member of the board but you do not have ambitions to become more involved in politics. You enjoy the position that you have now and you do only what you need to do to win the seat in election years. You were selected to serve on the special commission because you have been on the board longer than anyone. You like to see everyone happy and you avoid conflict and controversy whenever possible.

You will be looking for an easy uncomplicated solution to the problem. You go along with the majority.

John Honest, *Member, City Council*

The City Council is a group of elected citizens that manages the affairs of the city.

You are a born politician. You are the youngest person ever to hold a seat on the City Council! You enjoy solving

problems and being involved with the people. To you, that is where the action is. You are very ambitious, and you plan to run for Mayor when you feel the time is right. You handle yourself in such a way that people recognize how adept you are at handling problems. You are alert, perceptive, and articulate. You know what will influence voters to continue their support of you—strong leadership with a sincere concern for their welfare.

You take the lead in asking for specific cost factors of what is produced.

Sophia Rule, *Executive Judge, Pretty Good County*

The Executive Judge is the chief elected judicial officer of Pretty Good County.

You have lived in Pretty Good County all your life. Your family has been involved in politics as long as you can remember. You know everyone in the county and call them by their first names.

You have seen many changes in your community. A lot of folks don't like so many changes; they prefer to keep things the way that they have always been. You want to ensure waste management services to the county continue.

You take the lead in asking speakers if they would be willing to contribute to the cost of the services that they want or how the services would be financed.

Jacob Repp, *Citizen-at-Large, City/County Special Commission on Waste Management*

The Citizen-at-Large holds a non-elected position and represents the residents of Pretty Good County, including those that live in the city and towns.

You have been asked to represent the general population on the City/County Special Commission on Waste Management. You appreciate the opportunity to serve in this role because you have spent many hours working on community projects to improve the quality of life in Center City. In your business life, you strive to see each one's point of view and have gained a reputation for being fair. You are not beholden to any special interest group. At the same time, you realize the importance of this decision and how it will affect the community for many years. You want to make a decision that will be in the best interest of all the people, including the growth of the city and the protection of the environment. You take this responsibility very seriously.

You take the lead in asking questions about the impact on the environment of what is proposed.

Citizens

Mia T. Chur, *Impacted Landowner*

This landowner is directly affected by the proximity of the landfill.

(MRF) You are a retired school teacher who has been recently widowed. You have lived in your current residence for 45 years. You owned the home before the city purchased the land and constructed the landfill. You are active in community affairs, often volunteering 25 hours per week to various organizations that you feel are important to the welfare of Center City.

Although several acres separate your house from the landfill, you have encountered problems with flies, rats, and foul odors. You are concerned about the local water supply and are in the process of having your water tested.

You are a small voice and need to find others that share your feelings and concerns. You do not want more landfill and feel that the health of Center City residents would be better served by a good recycling program.

Brantley Pater, Impacted Landowner

This landowner is directly affected by the location and operations related to the landfill.

(MRF) You are a single parent of two elementary-age children. Your home is on the road to the landfill. Heavy traffic and roadside litter make it unsafe for your children to ride their bikes, or walk to the school bus stop. Litter blowing into your yard, flies, rats, and an unpleasant odor make outdoor activities impossible. You do not want to increase the size of the landfill. **You would like the city to enact mandatory recycling and a Materials Recovery Facility constructed.**

Mica Deal, Realtor

A realtor helps people sell or buy land or buildings.

(LF) You have been named a Outstanding Realtor of the Year for several years. The award is indicative of your aggressive marketing techniques. There is a building boom coming and you want Center City to be part of the coming development. You do not want to see taxes or fees increase. **You believe that increasing the capacity of the current landfill is the fastest and cheapest solution.**

Madison Marquett, President, Center City Chamber of Commerce

The Chamber of Commerce is a council of business people that promotes the commercial sector of a community.

(LF) Several new industries are interested in opening operations in Center City. Part of their incentive package includes free waste disposal during construction and the first year of operation. If recycling is implemented the industries may chose to go elsewhere rather than deal with managing their waste. **You support building more landfill space to ensure convenience to industry.**

Mason Commander, Factory Worker

The location of a factory worker's home is dictated by the location or relocation of the company for which they work.

(RS) You are a foreman in production work. You "worked your way up" to the job you now have, and you like it. You don't want to see your company move because of increased fees or taxes. You think that Center City should "Restrict Services" only allowing MSW from Center City into the landfill. Let the rest of the county deal with their own waste.

Adam Upp, Certified Public Accountant (CPA)

A CPA inspects, keeps, or adjusts financial reports such as income tax reports.

(C) Construction of a new landfill or expanding the current landfill is very costly. You believe that Center City should begin composting, yard waste, food waste and shredded paper. The city could use the compost in public landscapes and sell the excess, thus saving and making money.

Mary Worker, Office Manager

An office manager supervises the daily operations of an office.

(C) You are new to the community. You moved to Center City for better wages. You are not happy about the possibility of your new larger paycheck being reduced by taxes and fee increases to build of increase landfill space. **You have been composting for years and think that the city should compost.**

Delilah Dell, Farmer

It is important to farmers to maintain the agricultural heritage passed down to them by their families.

(C) You are a small farm operator. Recent drops in grain prices and increases in fuel process has made making a profit almost impossible. You have been purchasing compost by the ton for years. **You think Center City should start composting and maybe citizens could get a good rate on purchasing the compost produced. It would sure be a hit with the area farmers.**

Noah Hoarder, Taxpayer

(RS) You are not in favor of more taxes being spent on garbage. You barley use the current refuse system. Why should you be penalizes for other people's lack of conservatism and frugal living. **You think "Restricting Services" is the way to go. Only accept MSW from Center City, let the county folks hike their taxes.**

Emma Chief, Native American

(SR) You are a Native American. Your forefathers established this community site. They instilled in you a conservation ethic. **You believe the city should create source reduction ordinances. Stop garbage before it is created.**

(SR) Major Mullah, Financial Advisor

Financial advisors assist people and businesses in making investments, and planning for future financial activities such as paying for children's education or retirement.

You are a strategic planner, a person that thinks ahead. You believe in prevention and stopping things before they become an issue rather than after they have become a problem. **You think source reduction is the way to go.**

Gael Proffitt, Industrial Developer

An industrial developer selects sites and oversees the planning and construction of facilities for new industrial development.

(WTE) You have been given the responsibility of locating a site for expansion by a large industrial Plant. Pretty Good County is the top pick because it is close to the company's resource suppliers, has good roads, and lower land prices than other communities being considered. This company, your client is a "Green" industry and places high value on protecting the environment and resource conservation. Bringing this company to Pretty Good County will bring jobs and the potential of creating a "Green Industries" industrial park which could significantly impact the economic stability of the community, not to mention your personal finances. **You would like to see Waste-to-Energy facility implemented to supplement the landfill operation.**



Sheri Banks, *President First National Bank of Center City*

The bank President is a well-educated person and is responsible for the overall direction and administration of programs and services provided by the bank.

(WTE) You have lived in Center City all your life and are personally concerned about the quality of life in Center City. You are aware of the connections between a health environment and a health, thriving community. **You and the bank support alternative energy initiatives and believe that a Waste-to-Energy facility is the best choice for improving waste management in Center City.**

Zero Waste Alliance, *Citizens that are new to Pretty Good County form communities around the world where zero waste is the goal.*

Rose from San Francisco (ZWA)

Pipper from Whistler, British Columbia (ZWA)

Sandy from Hawaii, the Big Island (ZWA)

Willie from Austin, Texas (ZWA)

Annika from Sweden (ZWA)

Ryder from Australia (ZWA)

Olivia from New Zealand (ZWA)

Aryan from Kanchrapara, West Bengal, India (ZWA)

Riko from Kamikatsu, Japan (ZWA)

Dumaka from Africa (ZWA)

Zera from Singapore (ZWA)

You each come from places that have zero waste initiatives. You want to share some short-term and long-term solutions based on your experiences in zero waste planning. You love Pretty Good County and want to be an active citizen acting for the good of the community now and in the future.

Solutions Work Page

Use the answers to these questions to assist in making your presentation.

1. How many tons of trash do the citizens of Pretty Good County produce each year?
2. If the prediction is that at current usage rates the life expectancy of the landfill is 10 years, how many tons will it take to fill the landfill?
3. Based on the pie chart of the percent of MSW by category, i.e. yard waste, paper/paper board, how many tons of waste would your proposal remove annually?
4. How much time would your proposal add to the life of the landfill?
5. What is a reasonable estimate of the cost of your proposal?
6. What are the environment impacts of your proposal?

Team Assessment

	Needs Improvement	Satisfactory	Excellent
Participation	<p>Team members did not make adequate contributions to the discussions</p> <p>They did not engage in discussing Planning and Presentation</p>	<p>Team members made adequate contributions to the discussions</p> <p>They engaged in discussing some of the planning and presentation</p>	<p>Team members contributed regularly, and fully.</p> <p>They completed assigned work checked in often to report their progress and encourage others</p> <p>They engaged in discussing planning and presentation, and joined consensus on how to organize the team.</p>
Activities	<p>Not all team members participated</p>	<p>Team members participated in character but some performed poorly or inappropriately</p>	<p>Team members all contributed as would be appropriate for their character and described the ideas for responses</p>
Collaboration	<p>Team members did not discuss or participate</p> <p>The Team didn't reach consensus or make necessary decisions</p> <p>Work was not divided fairly Disproportionate work done by teammates, as evidenced in discussions</p>	<p>Team members all participated</p> <p>Work was shared equally among the team</p> <p>The team completed the assignment</p>	<p>Team members all participated and offered ideas, suggestions, and advice</p> <p>Team showed evidence of creative problem-solving</p> <p>Tasks were divided in an efficient way, with work shared equally</p> <p>Team completed in a timely manner</p>

Individual Assessment

Criteria	Could Be Better	Satisfactory	Excellent
Participation in decision-making within the group	Made no suggestions or comments to help manage the group through the project	Made some comments on others suggestions or agreed on how to manage the group through the project process	Made suggestions and helped manage group through the project process
Interaction with the group	Did not interact or did not meet the minimum requirements for the group activity.	Met the minimum requirements for the group activity but did not participate fully.	Participated throughout the project and met or exceeded the requirements.
Contribution to the group	Did not contribute to the activity.	Contributed to some of the activity but not all or did not do fair share.	Contributed to the assignment and did part in fulfilling the requirements for the assignment.
Group performance	Got behind and/or tasks were incomplete	Followed the task assignment and completed most of them by the deadline date.	Completed the tasks effectively and on time.
Individual Follow-Up	Did not review other group work	Reviewed other group work and commented but did not comment as instructed	Reviewed other group postings and commented as instructed

Earth: The Apple of Our Eye

Demonstrating the Limited Supply of Natural Resources Available for Human Use

“Conservation is a state of harmony between men and land.”

Aldo Leopold

Concept

Earth's resources are finite.

Objective

Students will comprehend that the earth and all its resources are finite. Students will be motivated to learn more about human impacts and sustainability.

Teacher Support and Student Engagement

Background Source Reduction

Where on Earth are You?

<http://www.google.com/earth/index.html>

Series on the State of the Planet

<http://www.pbs.org/journeypolanetearth/stateoftheplanet/index.html>

What does earth sound like from space? Click on the red arrow /Earth chorus

<http://soundcloud.com/carlfranzen/earth-chorus-emfisis>

Download and print a free poster of earth at night

<http://www.earthexplore.com/layersposter.html>

Brief

Protecting our land resources is vital to human sustainability. Advances in agricultural technology have enabled the world to feed many of its people, but population continues to expand. A fixed land resource and a constantly increasing population causes each portion to become smaller and smaller.

Materials

One clean apple, one knife, and one paper plate per working group. Optional: globe or world maps

Vocabulary

Finite, sustainability, inhospitable, scarcity.



I. Exploration/ Procedure

- A. Slice the apple into 4 quarters, setting aside three. The three quarters represent the oceans of the world.
- B. What fraction remains? ($\frac{1}{4}$)
- c. This fourth quarter represents earth's land area
Slice this land in half and set aside one of the pieces. The portion set aside represents land area inhospitable to people: polar areas, deserts, swamps, and high or rocky mountains.
- D. What fraction now remains? ($\frac{1}{8}$)
- E. The remaining piece represents land areas where people now live but not necessarily where they grow the foods needed for life. Slice the $\frac{1}{8}$ piece into four sections and set aside three sections.
- F. What fraction remains? ($\frac{1}{32}$)
- G. The $\frac{3}{32}$ set aside represents the areas which are too rocky, wet, cold, steep, or where soil is too poor to produce food. They also contain the cities, suburban sprawl, highways, shopping centers, schools, parks, factories, parking lots, and other places people live and grow food.
- H. Carefully peel the $\frac{1}{32}$ slice of the remaining apple. This tiny bit of peel represents the very thin surface of the earth's crust upon which humans depend for food. (Eat or compost apples and collect knives).

II. Explanation/Discussion

Discuss the implications of human dependence on the $\frac{1}{32}$. Potential questions or discussion might include:

What does this say about our relationship with the earth?

How will food production's scarcity influence hunger as populations grow?

How does pollution of natural resources impact human sustainability?

III. Elaboration/Extension

Have students research the land/water statistics from the Apple activity to determine more accurate percentages of each identified portion of the earth, i.e.: oceans, landmasses, human inhabited lands, etc. Create a spreadsheet to record the data. Use the spreadsheet software to create graphs or charts.

IV. Evaluation

Our planet's resources are finite. What does this mean to human sustainability? Land, air and water are the resources we all need for survival. Select one of these resources and create an outline or word map to display ideas and actions for protecting and conserving that resource.

Get the Facts

Hazardous Household Waste

“A passive and ignorant citizenry will never create a sustainable world.”

Andrew Gaines

Concept

Informed citizens are necessary for a healthy environment.

Objectives

Students will be able to (1) define hazardous waste, (2) research the toxicity of some common HHW including electronics, and their proper handling and disposal, and (3) collect and analyze data relating to community use and disposal habits of HHW. Students will understand the process and importance of becoming an informed citizen.

Teacher Support and Student Engagement

Background Garbage Basics

EPA general e-cycling information
<http://www.epa.gov/epawaste/conserve/materials/ecycling/index.htm>

EPA statistics on management of end-of-life electronics:
<http://www.epa.gov/epawaste/conserve/materials/ecycling/manage.htm>

National Geographic articles and interactive e-cycling information
<http://ngm.nationalgeographic.com/2008/01/high-tech-trash/carroll-text>

Survey apps
<http://www.quicktapssurvey.com/>

Survey Monkey

<http://www.surveymonkey.com/mp/lp/createsurveys/>

Google Docs

http://google.about.com/od/toolsfortheoffice/ss/forms_googledoc.htm

YouTube for creating Google survey

<http://www.youtube.com/watch?v=gwQ4KAlykq4>

Hazardous Waste & Brain Health

http://www.niehs.nih.gov/health/assets/docs_a_e/ehp_student_edition_lesson_depleted_uranium_and_the_brain.pdf

Brief

Helping students become citizens that demonstrate active, informed, and purposeful citizenship is key to the development of sustainable environmental policies. Active citizenship requires the development of civic literacy skills such as research and inquiry, collaboration, critical and creative thinking, and decision making. Students need to understand the role of the citizen, both the moral and legal responsibilities, in governing a community where values are always changing, there are multiple perspectives, and differing views. The purpose of this activity is for students to become informed about hazardous waste, governments role in regulation of hazardous waste, and the influence of personal and community usage and disposal habits on the local and global environment.

Materials

Student HHW Sheet

Vocabulary

hazardous household waste, pesticide, herbicide

I. Exploration/Procedure

1. Provide each student or team with a copy of the Student HHW Sheet.
2. Assign each student/team an item from the list to research.
3. Have students complete the questions.

II. Explanation/Discussion

Have students present their findings. Create a group summary and discuss the following questions. What was the most lethal item? What resources does your community have for handling HHW? What was the average number of HHW items used by student families?

III. Elaboration/Extension

Discuss with students the importance of understanding the culture of a community in order to develop and implement sustainable environmental solutions. Tell students that they will be developing a survey about the use and management of HHW in their community. The survey will be used to identify areas of information and service gaps needed to insure environmentally sustainable practices relating to HHW in their community. Brainstorm what questions the survey should ask. What type of questions should they use; open-ended, scale, multiple choice or dichotomous? Will they use several question types? How will the survey be administered? Discuss the options (resources for electronic surveys and mobile apps above) for survey delivery. Can the survey be placed on the Parent page for the school? Divide students into teams to develop a survey. Have teams compare surveys and select one survey or combine several into the final survey. You may decide to use one method of delivery or several but all surveys should include the same questions in the same order, this is for ease of tabulation of results and to insure that the question order did not create a difference/influence on the survey.

IV. Evaluation

Each team should tabulate their survey findings then create a summary of all the surveys. Can you identify areas that need addressing to improve environmental impact of HHW on the community? What is the HHW management literacy of the community in general? Brainstorm solutions or interventions to address community needs. Have students make presentations or write letters about their findings and suggestions to the appropriate organizations or people.

HHW Student Sheet

List of some common HHW items:

Round-up Herbicide	Wasp/Hornet Spray	Antifreeze
Spray Paint	Laptop Computer*	Smart Phone*
Computer CPU*	Computer Monitor*	Motor Oil/Filters
Lithium Battery*	Alkaline Battery*	NiCad Battery(rechargeable) *
Spectricide/Diazion	Malathion	Sodium Hypochlorite
Pharmaceuticals	Refrigerator*	Energy Saving Compact Fluorescent Light Bulbs*
Treated Wood*	Paint Thinner	Auto Battery*
Aspirin	Nail Polish Remover	Ammunition

* identify the product contained within the item that makes it HHW and answer the questions for that waste product

1. What is the item you are researching?

2. How is it properly stored?

3. How do you properly dispose of the item?

4. What is its LD50 rating and what does that mean?

5. Where/how do you properly dispose of this item in your community?

6. What are the hazards relating to this item?

7. How many of the items from the HHW list has your family used during the last year?

It's a Trashy World

What in the World Do We Do With Our Trash?

“Think globally, act locally”

unknown

Concept

Solid waste management differs around the world and is influenced by many factors.

Objective:

Students will research the solid waste management practices of countries around the world and evaluate the impacts of these practices on local and global health, economy and environment.

Teacher Support and Student Engagement

Interactive map of countries of the world, click on a country's name and map highlights it in red & provides demographics

<http://www.euratlas.net/geography/world/countries/index.html>

Interactive rivers of the world map, river highlights in blue and provides a list of countries that share this river.

<http://www.euratlas.net/geography/world/rivers/index.html>

World Bank report on global MSW management

<http://go.worldbank.org/BCQEPoTMOo>

Success story from Kenya

http://www.unep.org/PDF/Kenya_waste_mngnt_sector/chapter3.pdf

Brief

Urban waste generation is projected to exceed six million tons per day by the year 2025. Each country exhibits different challenges and potentials for the solid waste that it produces. UN-Habitat identifies three key components for solid waste management; public health, protecting the environment and management of resources. Not properly handling solid waste results in creating breeding grounds for insects and vermin. According to UN-Habitat research in 2009, areas where waste is not collected frequently the incidence of diarrhea is twice as high and acute respiratory infections 6 times higher than areas where collections are frequent. Improperly collected or disposed of trash contributes to pollution of surface and ground water as well as air pollution. Materials recovered from MSW collection can contribute significantly to the global market and economy. World markets for post-consumer metals and paper/cardboard alone are estimated to be \$30 billion. (UNHabitat2009).

Materials

Student sheet "World Trash Exploration"

Vocabulary

MSW, Population density, life expectancy, per capita, GDP, vermin

I. Exploration/ Procedure

1. Discuss with students the importance of the rivers of the world and their uses (drinking water, transportation, and irrigation). Use the "Did You Know" section from the UN Water for Life report to engage your students. <http://www.un.org/waterforlifedecade/quality.shtml> Ask students to think about the lesson quote "Think globally, act locally" and what it means.
2. Use a world rivers map to have students select a river and country to investigate. Make sure that all regions are well represented.
3. Have students research their selected country and river to answer the questions on the student World of Trash exploration sheet.
4. Enter each student's data into a master spreadsheet.
5. Provide green, blue, red and black push pins for students to mark their country on the map. Provide green pins for countries that have MSW management programs that recycle at least 30% of MSW, blue for countries that recycle 5-29% of their MSW, red for countries recycling less than 5% of their MSW, and black for countries with little or no MSW management system.

II. Explanation/Discussion

Discuss commonalities and differences of countries with a high level of MSW management and compare to those that have little or no MSW programs. Is there a country that has zero waste (no landfilling) or almost zero waste? How are they different from other countries? Discuss country size and population density as it relates to MSW management. Discuss the impacts of MSW management on water quality and quantity.

III. Elaboration/Extension

Study the map to determine regions with MSW problems. Have students research the health and pollution issues within these countries and discuss their possible relationship to MSW.

IV. Evaluation

Have students develop a plan for improving the way MSW is managed in the country that they have researched. Plans should include how improvements would be financed, who would manage the program, and what the impact might be on the local and global environment.

World of Trash Exploration

Name of the country you are researching: _____

The name of the river within this country that you are researching _____

What is the average life expectancy for someone born in this country? _____

What is the per capita income for this country? _____

What percent of the population lives in urban areas of this country? _____

Write a brief description of how this country manages MSW.

What is the Gross Domestic Product (GDP) of this country? _____

What is the size of this country in acres? _____

What is the population density
(how many people per acre of land) of this country? $\text{population} / \# \text{ acres} = \text{population density}$

What percent of MSW is captured for recycling? _____

The Social Blast

Creating social media to raise Waste awareness

“I've learned that people will forget what you said, people will forget what you did, but people will never forget how you made them feel.”

Maya Angelou

Concept

Communication is key to education about environmental issues, and takes many forms.

Objective

Students will be able to (1) describe the qualities of a social media campaign that make it effective, (2) define different types of social media and their uses, (3) define waste and identify waste related problems and practices, and promote solutions.

Teacher Support and Student Engagement

Best commercial Social Media Campaigns
<http://socialmediatoday.com/syed-noman-ali/1638021/best-social-media-campaigns-brands>

How to create WIKI page
<http://www.howtogeek.com/howto/34248/how-to-create-a-wiki-without-any-technical-know-how-using-google-sites/>

How to create a YouTube video and account
<http://www.youtube.com/watch?v=p2N72ACocFg>

Create a Blog
<http://www.wikihow.com/Start-a-Blog-on-Blogger>

Create a Survey Monkey Survey
http://www.surveymonkey.com/mp/lp/createsurveys/?utm_network=s&utm_

[term=survey+monkey&utm_campaign=p&gclid=CKi34Mj-_7gCFUFyQgodPQ8AyA&pdv=c&pmt=p&utm_source=adwords&mkwid=sQ6OhhZK3&utm_medium=ppc&source=SearchNetwork&cmpid=brand&pclid=32958752749&kw=survey+monkey](http://www.surveymonkey.com/mp/lp/createsurveys/?utm_network=s&utm_campaign=p&gclid=CKi34Mj-_7gCFUFyQgodPQ8AyA&pdv=c&pmt=p&utm_source=adwords&mkwid=sQ6OhhZK3&utm_medium=ppc&source=SearchNetwork&cmpid=brand&pclid=32958752749&kw=survey+monkey)

Create an internet Meme
<http://video.about.com/netforbeginners/What-is-an-Internet-Meme-.htm>

What is a VINE
[http://en.wikipedia.org/wiki/Vine_\(software\)](http://en.wikipedia.org/wiki/Vine_(software))

How to make a rubric
<http://www.cmu.edu/teaching/assessment/howto/assesslearning/rubrics.html>

Critique or Criticism
<http://scribesalley.blogspot.com/2008/08/difference-between-critique-and.html>

Brief

The opportunities for raising awareness about an issue or program have never been greater or more exciting than they are in today's social media arena. In her blog Jan Willis lists and explains the eight characteristics of an effective social media campaign. Have students read the full blog article for full explanations and examples.

<http://www.searchenginepeople.com/blog/effective-social-media-campaigns.html>

Highlights of effective social media campaigns are:

1. Targeted; have a set of clear objectives and success criteria. What are you trying to achieve, who is the audience you wish to engage, and what will success look like?
2. Focused; your campaign should be focused on a specific issue or problem. You should provide a direct response for your audience, the specific actions you wish them to make.
3. Measurable; once you begin your campaign it is important to begin measuring responses with appropriate metrics.
4. Great CONTENT; the cornerstone is great content presented in an interesting way. Know what your audience is passionate about and their preferred content type for sharing.
5. Simple; your campaign should be of some value to your audience. It may simply be the fun of engaging with your site but must be relevant to your message. Watch one of the most watched on-line ads ever: <http://www.youtube.com/watch?v=xdglPVHcogI> Evians Roller Babies or Johnsons facebook baby photo contest that generated more than 1 million visits <https://www.facebook.com/johnsonsbaby>.
6. The Right Medium for the Message; match the actions that you want users to take and match it to the correct medium. Integrate all your marketing, advertising, and PR activities, checkout the Keep America Beautiful related sites to include their efforts.
7. Memorable; forge emotional connections, provide not only great content but an experience. Tell your story in a way that your audience can immediately identify with, involve them in the conversation, make it personal. Tell the truth, be honest, and don't exaggerate.
8. Profitable; financial gain is not the only measure of profitability, actions that improve communities also has value that can be measured in economic terms. Look at your success measurement metrics.

Materials

Computers with internet access, digital camera

Vocabulary

social media, measurement metric, solid waste

I.Exploration/ Procedure

1. With students analyze the different types of social media (Facebook, Twitter, Memes, Vines, Pinterest, Wiki pages, YouTube, Survey Monkey) with emphasis on the characteristics that contribute to its appeal and effectiveness.
2. Explain to students that they will be creating a social media campaign about a solid waste issue or community greening. If you have done the [KAB Over the Rainbow](#) visioning activity you may select an issue from that list or you could lead the class in that activity now to identify an issue.
3. Divide the class into 2 teams, each team will review the elements of an effective social media campaign to create their campaign plan and select the different types of social media that their team will include in their campaign. Provide students with the time period for the project and the amount of class/ group time they will have to complete the project.
4. The teams will then divide into working groups to develop the components of their campaign. Each campaign should have at least 3 social media component types. Remind students that they must submit the first 3 steps, outlined in the article, for approval before beginning steps 4-8. Create a success measurement metrics using the objectives of your campaign.
5. Post links to your campaign project to the [KAB YAC Projects](#)

II. Explanation/Discussion

Have teams present their campaigns with each working group presenting their component so that all students participate. Have the teams evaluate each other's campaigns. Discuss constructive critiques versus criticism before beginning evaluations.

III. Elaboration/Extension

Create a class blog where every student reflects on their experience with the project and discusses what they learned about the issue and social media.

IV. Evaluation

1. Have student teams interpret the success of their campaign using the measurement metrics that they developed.
2. Discuss the comments in the class critique in light of the success of the campaign based on their measurement.



Recycling

Can This Last Forever?

Natural Resource Consumption

“Waste not, want not”

Benjamin Franklin

Concept

The influence of population growth on sustainability.

Objective

Students will be able to:

Predict the different amounts of consumed natural resources if consumption increases at different rates.

Graph these predictions as a function of time.

Compare and contrast these predictions.

Teacher Support and Student Engagement

Teaching with Ecological Footprint Calculators

<http://cft.vanderbilt.edu/guides-sub-pages/teaching-with-ecological-footprints/>

World Population Growth Rate

<http://www.indexmundi.com/g/r.aspx?v=24>

Cool Population Counter

<http://www.worldometers.info>

Petroleum Consumption

<http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=2&pid=2&aid=2>

US History of Petroleum Consumption

http://www.eia.gov/dnav/pet/pet_cons_psup_dc_nus_mbb_l_a.htm

Brief

Economists contend that as a particular resource becomes scarce and consequently more costly, society may switch to a substitute. This concept is

true, provided new technologies are developed to supply suitable substitutes. However, if society finds new, low-cost ways of obtaining the resource, or economic growth is such that the population can afford the rise in cost of the resources, it may continue to use it.

For example, oil is a nonrenewable or finite resource. In order to have oil in the future, the United States must discover new reserves, develop new technologies to use sources too costly now, or seek other energy alternatives. How long will it be before we are forced to choose an alternative?

It is possible to predict mathematically the amount (A) of a resource that will be consumed in the future based on data regarding consumption's rate of increase in the past. To do this, we must know the rate (r) of increase in consumption of the resource per year and the number (n) of years over which the consumption takes place (see “AN EXPONENTIAL FUNCTION: NATURAL RESOURCES CONSUMPTION,” found on the [teacher sheet](#).)

If the amount of consumption grows at a rate of r (percentage per year) from some initial value (A_0), after one year we have $A_1 = A_0(1+r)$.

After the second year, $A_2 = A_1(1+r) = A_0(1+r)^2$

After n years, $A_n = A_0(1+r)^n$.

This is called an **exponential function** and has the format $y = ab^x$, where b is an element of the set of real numbers (only positive) and x is an element of the set of real numbers.

This exponential function is continuous and increasing if b is greater than 1, but decreasing if b is less than 1.

Materials

Student Sheet—Natural Resources Consumption as a Function of Time: An Example

Vocabulary

Exponential Function, limited supply

I. Exploration/ Procedure

The Issue: Consumption of Natural Resources

A. Ask the students what they think will happen to the population of a specific animal when:

1. They eat only one type of plant, (plant may become extinct; when extinct, animal number declines.)
2. The Population of animals is on the rise (the plant would become extinct at a faster rate.)
3. There is no increase in the number of available plants (plant extinction would negatively affect the animal's population growth.)

Help the students discover that the plant used as food for the animals is a resource of limited supply. Help them understand that the population can grow exponentially, but as the food supply decreases in availability, the population drops off exponentially at a negative rate when $(1+r)$ is less than 1.

B. Discuss the following with students:

1. The concepts of "planned obsolescence" and "throw-away society."
2. Natural resources in terms of limited supply and classification as renewable and non-renewable, and the possible effect the "throw-away" philosophy might have on the future.

C. Discuss the equation used to predict the consumption of natural resources as a function of time. Be sure to explain what is meant by the term "exponential function."

The Prediction

A. The population of the United States is currently increasing at a rate of ~1%. [population counter](#) Assuming that the consumption of natural resources increases at approximately the same rate, compute and graph the following:

1. Using calculators that compute y^x , have students graph this function using the figures calculated above.
2. Have students graph, on the same coordinate axis, the function using a rate of increase of 0.9% per year.
3. Ask the students to examine the two graphs. What are the similarities and differences?
4. Let students graph this function using a 2% per year rate of increase.

B. Have students determine the supply of natural resources that could be saved over a 100-year period by decreasing the consumption increase rate from 2% to 0.9% per year.

II. Explanation/Discussion

- A. Discuss the possible results in our society if (a) there is a finite supply of natural resources, and (b) consumption growth continues at the present rate of population growth.
- B. If the consumption curve of a natural resource reaches an asymptote, what would this mean? (An asymptote is a line approached by a curve in the limit as the curve approaches infinity.) Since this condition is likely for some resources, what are some factors that could slow the depletion rate of our natural resources? How can a zero growth rate be accomplished?
- C. Have the students list the benefits of reducing the rate of resource consumption and the problems that a reduction would cause. Weigh the benefits against the problems.
- D. Which countries are increasing/decreasing consumption? [Petroleum Consumption](#)

III. Elaboration/Extension

Have students research and discuss the top ten most-used natural resources and their recycling rates.

IV. Evaluation

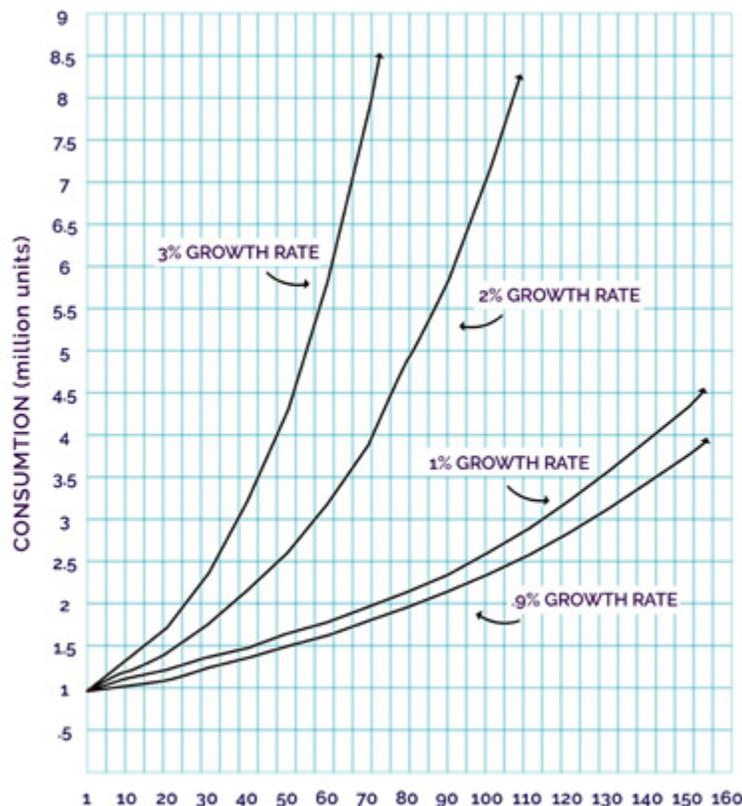
Teach/Footprint Calculators

- A. What are some probable future effects of the increasing consumption of natural resources?
- B. What are the benefits of reducing our consumption rate?
- C. List four ways to reduce the consumption rate of natural resources.
- D. What factors can slow the consumption rate?

AN EXPONENTIAL FUNCTION: NATURAL RESOURCES CONSUMPTION

$A_n = A(1+r)^n$				
If $A = 1,000,000$ units of a natural resource used initially, then increased usage at the given rates means usage will equal the given numbers of units.				
	0.9%	1.0%	2.0%	3.0%
years	$r = .009$	$r = .01$	$r = .02$	$r = .03$
10	1,093,733	1,104,622	1,218,994	1,343,916
20	1,196,253	1,220,190	1,485,947	1,806,112
30	1,308,383	1,347,489	1,811,361	2,427,262
40	1,431,023	1,488,863	2,208,039	3,262,037
50	1,565,158	1,644,632	2,691,588	4,383,906
60	1,711,866	1,816,697	3,281,030	5,891,603
70	1,872,326	2,006,763	3,999,558	7,917,821
80	2,047,827	2,216,715	4,875,439	10,640,891
90	2,239,778	2,448,632	5,943,133	14,300,467
100	2,449,721	2,704,813	7,244,646	
110	2,679,342	2,987,792	8,831,183	
120	2,930,488	3,300,386	10,765,163	
130	3,205,174	3,645,680	13,122,674	
140	3,505,607	4,027,099		
150	3,834,201	4,448,423		
160	4,193,596	4,913,826		

NATURAL RESOURCE CONSUMPTION AS A FUNCTION OF TIME: An example



COMPUTER PROGRAM

To generate a table of values of $E(n)$ using increments of 10 years and a 2 percent rate of increase.
(For TRS-80, C-64, and Apple)

```

READY
100 PRINT "S.";
110 INPUT "INITIAL AMOUNT";A
120 INPUT "RATE OF INCREASE";R
130 INPUT "NUMBER OF YEARS";N
140 PRINT "S.";
145 PRINT "YEAR#", "AMOUNT":PRINT
150 DIM A(N)
170 FOR I=1 TO N
180 :A(I)=A*(1+R) ↑ I
190 :PRINT I, A(I)
200 NEXT I
READY.

```

```

INITIAL AMOUNT? 100000
RATE OF INCREASE? .02
NUMBER OF YEARS? 80

```

<u>YEAR#</u>	<u>AMOUNT</u>	<u>YEAR</u>	<u>AMOUNT</u>	<u>YEAR</u>	<u>AMOUNT</u>
1	102000.000	28	174102.424	55	297173.077
2	104040.000	29	177584.472	56	303116.539
3	106120.800	30	181136.162	57	309178.870
4	108243.216	31	184758.885	58	315362.447
5	110408.081	32	188454.063	59	321669.696
6	112616.242	33	192223.144	60	328103.09
7	114868.567	34	196067.607	61	334665.152
8	117165.939	35	199988.959	62	341358.456
9	119509.258	36	203988.739	63	348185.625
10	121899.443	37	208068.514	64	355149.338
11	124337.432	38	212229.884	65	362252.325
12	126824.180	39	216474.482	66	369497.371
13	129360.664	40	220803.972	67	376887.319
14	131947.877	41	225220.051	68	384425.066
15	134586.835	42	229724.452	69	392113.567
16	137278.572	43	234318.941	70	399955.839
17	140024.143	44	239005.320	71	407954.956
18	142824.626	45	243785.427	72	416114.055
19	145681.119	46	248661.136	73	424436.337
20	148594.741	47	253634.359	74	432925.063
21	151566.636	48	258707.046	75	441583.565
22	154597.969	49	263881.187	76	450415.237
23	157689.929	50	269158.811	77	459423.542
24	160843.727	51	274541.987	78	468612.013
25	164060.602	52	280032.827	79	477984.253
26	167341.814	53	285633.484	80	487543.939
27	170688.650	54	291346.154		

Composting

Organic Waste, It's a Gas

“Innovation is the central issue in economic prosperity.”

Michael Porter

Concept

Composting organic waste products takes many forms and provides numerous opportunities for contributing to a sustainable lifestyle.

Objective

Students will be able to define composting and the difference in aerobic and anaerobic environments as they relate to landfills and composting.

Students will construct a working model of a biomass digester to create biogas (methane)

Students will explore biomass digesters as a waste management option.

Teacher Support and Student Engagement

[Background Composting](#)

[How a landfill works video](#)

COW POWER

[Video of family dairy farm creating and using biofuels from animal waste.](#)

Brief

According to the EPA methane (CH₄) is the second most prevalent greenhouse gas emitted from human activities. Food waste makes up the largest percentage (21%) of waste going into municipal landfills. Additional compostable materials include yard trimmings composing 9% of waste to landfills. When these items are disposed of in landfills and begin to rot they become a significant

source of methane, a greenhouse gas that has 21 times the global warming potential of carbon dioxide. Composting is the aerobic, biological decomposition of organic materials. Because the decomposition takes place in an oxygen rich environment methane gas is not produced, but the end result of composting is a nutrient-rich soil additive called compost. In the anaerobic environment of a landfill the decomposing organic matter produces methane gas.

Materials

20 liter water bottle with cap, 6-8 foot piece of 1 inch PVC Pipe, 2, 1 inch PVC caps, gas valve to fit tubing, ¼ inch plastic tubing, tee to fit tubing, tire inner tube, outdoor caulking, hacksaw, 1 inch hole saw, paint brush, black paint for plastic, cutting tool for plastic, 10 kg of raw manure (not composted) and 10 liters of water. Other organic materials can be used in place of manure or in combination with the manure, but the manure works best.

Vocabulary

Methane, greenhouse gas, biofuel, anaerobic, anaerobic, composting, compost

I. Exploration/ Procedure

1. Do a [Carousel Brainstorming Session \(CBS\)](#) (Create 4 charts with the following topics; Greenhouse gas, Landfill, Biofuel, and Problems facing citizens of developing countries. Complete the CBS and watch the How a landfill works video.
2. Open discussion on aerobic and anaerobic decomposition. Introduce composting as a method of aerobic decomposition.
3. Divide students into teams, one team is to research the benefits and limitations of using MSW organic materials decomposition to create methane as a biofuel, and the other team to research the benefits and limitations of composting MSW organic materials.
4. Have the teams include in their research what your community does with organic waste. Do they incinerate, compost, or landfill? What happens to the methane produced?
5. Compare team results.

II. Explanation/Discussion

Discuss what the limitations for handling organic MSW are in your community. What are some ways to reduce the sources of food and yard waste entering the MSW stream? Discuss that there are countries where public access to gas for heating, cooking, and light are very limited. Watch the Cow Power video. Ask students if they can think of a way to provide gas to homes in countries without adequate power. Introduce the Biogas Digester Experiment. See Experiment page. For a visual introduction watch the [Pakistan Science Club video](#)

III. Elaboration/Extension

Have students research the amount of manure produced by various types of livestock on a small farm in a developing country. Based on the results of their experiments how much methane could a small farm expect to produce?

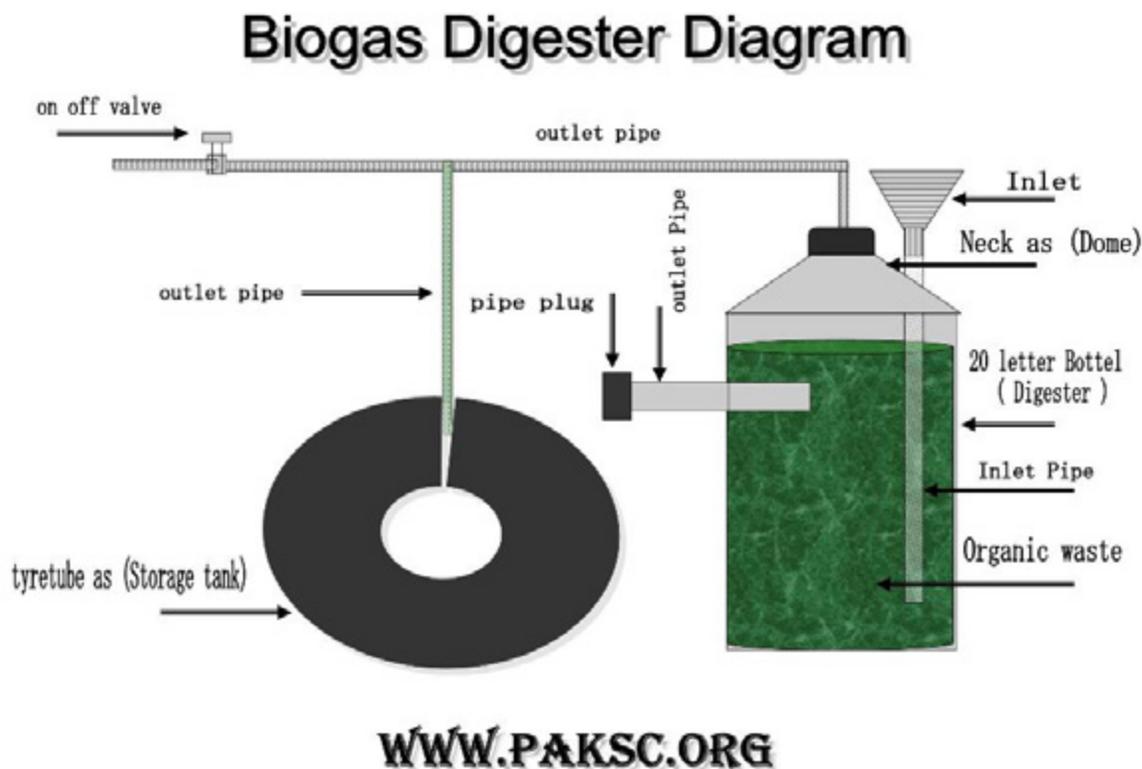
IV. Evaluation

What are the best methods of managing food waste and yard trimmings in your community? If these methods are not being used how could the community work to implement the changes? Repeat the Carousel Brainstorming activity and look for new learning.

Biogas Digester Experiment

A biogas digester uses organic material (plant waste and manure) in an anaerobic environment to make and store methane gas. This experience describes two types, a large digester that can produce enough gas to power a gas cooking ring and a small digester to collect small amounts of methane gas in a balloon. The smaller digester is good for experiments into what organic materials produces the most methane gas.

Large Digester (diagram Pakistan Science Club)



Things to keep in mind during construction of the digester and completion of the experiment.

1. The container must be air tight. Why? Needs anaerobic conditions.
2. The container should not be transparent or translucent. Why? Sunlight would encourage algae growth and oxygen production creating aerobic conditions.
3. Remember you are creating a flammable gas, work safely.
4. Avoid subjecting the digester to direct sunlight, keep it in an area with temperatures between 30C-40C.
5. Always turn valves away from your face and away from other students.
6. If results are not found within a week check tubes and valves for clogs.
7. Feed the digester 1 liter of fresh biological mixture daily (50% waste/50% water). Remove the outlet pipe plug cover before adding the daily mixture to handle the overflow from the digester. Add the overflow to your compost pile. Replace the pipe plugs and shake the digester to mix old & new materials.

Construction

Assemble materials, tools and appropriate safety equipment.

Measure the PVC to match the height of the water bottle, mark the PVC and cut. This is the inlet pipe.

Mark the bottle for making the hole for the PVC inlet pipe. Cut the hole and inset the inlet pipe. Pull the inlet pipe back up until it is about 2 inches off the bottom of the bottle. Glue/caulk the pipe in place. Cover with the plug cap.

Now measure the outlet pipe length. It should reach midway into the bottle. Cut the PVC pipe and mark hole placement on side of the bottle. Cut the hole, insert the outlet pipe and caulk in place. Cover with PVC plug cap.

In the neck or dome of the bottle cut a hole for the tubing that is the outlet pipe. Insert tubing and caulk in place. Leave a length of outlet tubing long enough for the tire collector to be away from the tank and lay flat. Cut outlet tubing and inset tee.

Add tubing to tee to reach the tire and connect. Add tubing to other end of tee and cap the final tube end with the on/off valve.

Paint the bottle black.

Mix manure and water in a bucket, use the funnel to pour mixture into the digester bottle through the inlet pipe. Recap pipe, shake and place in designated storage area.

Mix 1 liter of fresh mix and add daily. Don't forget to remove the outlet pipe plug before adding new mixture. Place a container under the outlet pipe to collect the overflow.

When the tire is inflated with gas confirm methane production by opening the on/off valve and igniting the gas.

Small digester

Use a 2 liter soda bottle, add organic material (1/4th cup) or combination of organic matter. Fill half way with water and shake. Continue filling with water until filled to the very top of bottle. Cap with a balloon and duct tape in place. Cut the bottom off of a paper lunch sack creating a paper tube. Mark the paper tube with the organic material in the digester and the start date. Slip the paper tube over the bottle. Use a string to measure around the balloon as it inflates. Measure daily and record the measurements. Compare results.

What does it Mean to be Green?

“Conservation means development as much as it does protection. I recognize the right and duty of this generation to develop and use the natural resources of our land; but I do not recognize the right to waste them, or to rob, by wasteful use, the generations that come after us.”

Theodore Roosevelt

Concept

Conservation decisions have an environmental and economic impact.

Objective

Students will understand what green building means and how it can be achieved including the use of materials that have recycled content and salvaged materials. Students will explore and understand the environmental and economic elements of green building.

Teacher Support and Student Engagement

Leadership in Energy and Environmental Design (LEED)

http://en.wikipedia.org/wiki/Leadership_in_Energy_and_Environmental_Design

Smart Communities Network/Green Building Principles

<http://www.smartcommunities.ncat.org/buildings/gbprinc.shtml>

EPA Recycled Materials Supplier Directory

<http://www.epa.gov/epawaste/conservation/tools/cpg/directory.htm>

[Payback Analysis](#)

Brief

The KAB Mission is to engage individuals to take greater responsibility for improving their community's environment. That environment includes the places we work, live, learn and play. In our mission students can play a major role in encouraging change for sustainable development and practices, especially in our schools.

Materials

None

Vocabulary

Green building, sustainability, environmental impact, economic impact

I. Exploration/ Procedure

1. Divide students into research and design teams to explore the definition of green building using the principles of green building discussed on the Smart Communities Network website.
2. Have the teams identify elements of green building principles that they have observed in practice at their school. What elements of green building are missing?
3. Teams should identify changes that they believe are practical to implement now and changes that should be made in the future as repair or replacement occurs overtime. Students can research products made from recycled materials using the EPA Recycled Materials Supplier Directory.

II. Explanation/Discussion

Teams should present their ideas for greening the school. How green do students think that their school is currently? Which idea do students think is the most important green building element to implement immediately?

III. Elaboration/Extension

Discuss the terms environmental impact and economic impact.

IV. Evaluation

Have students list the environmental and economic impacts of the green building element that they identified as being the most important to implement immediately. Example : How much water will it conserve and what would be the dollar value of that unused water /or cost of that water?

Trash to Treasure

What does your trash want to be?

“You must be the change you wish to see in the world”

Mahatma Gandhi

Concept

Recycling sustainability is dependent on the creation of new products from the recycled materials and a consumer market for those new products.

Objective

Students will understand the environmental impacts of their actions on long-term sustainability and the economic impacts of their personal and group choices. Students will collect and interpret data to design solutions.

Teacher Support and Student Engagement

Discover how garbage gets a new life

<http://www.iwanttoberecycled.org/journey>

Materials Recovery Facility (MRF) and Single-stream recycling-How it Works

http://www.youtube.com/watch?v=J_RWqgXcP_k

Milk Jugs to Plastic Fence

<http://www.youtube.com/watch?v=-JQYwF4VyiY>

Plastic Bottle Structures

<http://www.inspirationgreen.com/plastic-bottle-homes.html>

Plastic Bottle Greenhouse

<http://www.squidoo.com/plasticbottlegreenhouse>

KAB Fast Facts: Recycling

<http://www.kab.org/site/>

[PageServer?pagename=recycling_facts_and_stats](http://www.kab.org/site/PageServer?pagename=recycling_facts_and_stats)

Information about amounts of recycling and economic and environmental benefits of each material recycled

http://www.epa.gov/osw/nonhaz/municipal/pubs/MSWcharacterization_508_053113_fs.pdf

Brief

The recycling of solid waste materials provides benefits that are environmentally and economically beneficial to our world. Some of those benefits, according to the U.S. EPA, are that recycling:

Conserves natural resources to help sustain the environment.

Reduces the need for landfilling and incineration.

Saves energy and prevents pollution caused by the extraction and processing of virgin materials.

Decreases emissions of greenhouse gases.

Expands U.S. manufacturing jobs and increases U.S. competitiveness.

Each community has different methods of recycling from volunteer collection and drop-off of materials to single stream [Materials Recovery Facilities](#)

Materials

Recycling collection containers, enough for one day of collection, Benefits Calculation data sheet, and scale for weighing materials

Vocabulary

MRF, single stream recycling, conservation

I. Exploration/ Procedure

1. Discuss with the group the benefits of recycling and the different ways communities handle recycling. Watch the MRF video. How does your community handle recycling? What materials can you recycle in your community?
2. Tell students that the group is going to explore the potential environmental and economic impacts of personal recycling. Each student is to collect the items (to be determined by the teacher) they personally used that can be recycled for one day. All the materials will be brought to class and sorted and weighed.
3. As a group calculate the potential amount, in one year, of recyclable material from each category based on the amount collected. Potential amount for recycling= total amount collected by group x 365.

II. Explanation/Discussion

Divide group into teams to research the benefits of the materials that the class could collect in one year. Each team will complete the Benefits Calculation Data Sheet. Have groups present their findings and compare and discuss differences.

III. Elaboration/Extension

Students develop a recycling event to collect recyclables to sell to raise funds to purchase a product made from recycled materials. Example: students collect aluminum cans to purchase carpet made from recycled plastic and donate it to Habitat for Humanity.

IV. Evaluation

Have students develop a personal recycling plan based on their product usage and recycling options available to them.

Recycling Benefits Calculation Data Sheet

Material	Annual Amount Collected	Landfill Space Saved	Energy Saved	Polution Prevented	Products Produced	Jobs Created

Partner Lesson

Council for Economic Education

The Economics of Recycling

Demand, Incentives, and Supply; comparing recycling in Japan and the USA

<http://www.econedlink.org/lessons/index.php?lid=218&type=educator>

Dumptown USA: Making a Ton of Difference

Identifying primary sources of waste and comparing recycling programs for cost-effectiveness

<http://www.econedlink.org/lessons/index.php?lid=746&type=educator>





Personal Responsibility

Over the Rainbow

A First Look at Vision for Change

“Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has.”

Margaret Mead

Concept

Students collaborate to create a graphic representation of their hierarchy for change.

Objective

Students will understand that change begins with the purposeful decision of one individual to do things differently. Students will envision the changes that they want to make relating to solid waste management, litter, or community greening and systematically plan to make those changes.

Teacher Support and Student Engagement

Meet the KAB Youth Advisory Council

<https://www.kab.org/our-programs/education/youth-advisory-council>

[What is Service-Learning?](#)

State Farm Service Learning Grant

<http://www.statefarmyab.com/apply/national-grants/>

KAB National Awards

<https://www.kab.org/news-info/annual-awards>

Brief

KAB beliefs: People and places are profoundly connected. Thriving communities are rooted in individual responsibility and action. Lasting change happens when people work together. Through community service, youth can lead the way to a better community while developing important experience and skills. Read and discuss the biographic sketches of the KAB Youth Advisory Council. See Teacher Support and Student Engagement section.

Materials

Colored sheets of paper: One sheet of each color (red, orange, yellow, green, blue, indigo, and violet) per team and seven pushpins. Black markers.

Vocabulary

Service-learning, visioning, empathy, feasibility

I. Exploration/Procedures

1. As a group, discuss the meaning of community. What does it mean to create a vision for the future? As a group select the change topic : solid waste management, litter or community greening.
2. Divide the students into groups. Give each group a set of Rainbow cards. Tell them that they are going to create a vision for the future of their community. On the cards, they should write the things that they think need to change, and how to change them.
3. They should have a list of 7 things.
4. Once they have a list they will prioritize them in order from the most needed to the least needed. The most needed will go on the Red paper as red is the top color of the rainbow. Keep prioritizing through the colors of the rainbow; red, orange, yellow, green, blue, indigo and violet.

II. Explanation/Discussion

Have each team present their ideas for change making a rainbow of ideas. Use push pins to attach the colored cards to the board.

III. Elaboration/Extension

Discuss with students the reoccurring themes. Would some groups be willing to change their priority in order to make a complete rainbow? Are there change ideas in each color of the rainbow that would be appropriate and feasible for your students to do?

IV. Evaluate

Have students reorganize "Change" ideas into two variables "Need" and "Feasibility".

Keep the Change Rainbow available for review throughout the year as students select service- learning projects and seek volunteer opportunities.



Apps Library

APPS/Android

Carbon Footprint Calculator

<https://play.google.com/store/apps/details?id=com.carbonfootprintcalc.kuc>

Tree ID & Description

<https://play.google.com/store/apps/details?id=org.pottssoftware.agps21>

Photo Plant and ID

<https://play.google.com/store/apps/details?id=air.be.trendsco.plantifier>

Recycling Classification Game

<https://play.google.com/store/apps/details?id=com.aidem.android.toss>

Resource for Pricing and Selling Recycled Electronics

<https://play.google.com/store/apps/details?id=com.atomjuice.compareandrecycle>

Unit Converter

<https://play.google.com/store/apps/details?id=com.physphil.android.unitconverterultimate>

Photo Combining for Instagram: Diptic or PicFram for Android

<https://play.google.com/store/apps/details?id=com.picframes.android&hl=en>

<https://play.google.com/store/apps/details?id=com.peaksystems.diptic&hl=en>

APPS iPad

Composting (\$.99)

<https://itunes.apple.com/us/app/home-composting-for-organic/id579278583?mt=8>

Leafsnap Tree ID

<https://itunes.apple.com/us/app/leafsnap-for-ipad/id433522683>

Convert – The Unit Calculator (\$1.99)

<https://itunes.apple.com/us/app/convert-the-unit-calculator/id325758140?mt=8>

Where to Recycle

<https://itunes.apple.com/us/app/irecycle/id312708176?mt=8>

<http://iwanttoberecycled.org>

Personal carbon footprint and offset calculator

<http://www.nature.org/greenliving/carboncalculator/>

Photo Combining for Instagram: Diptic or PicFram for iPhone

<https://itunes.apple.com/us/app/picframe/id433398108?mt=8>

<https://itunes.apple.com/us/app/diptic/id377989827?mt=8>



Fast 5 Videos

Fast 5 Video Links

Litter

<https://www.youtube.com/watch?v=mpgPFbt6UfE&feature=youtu.be>

Composting

<https://www.youtube.com/watch?v=rhlx0-xQ0jY&feature=youtu.be>

Waste to Energy

<https://www.youtube.com/watch?v=Xict7tgyZQ4&feature=youtu.be>

Garbage Basics

<https://www.youtube.com/watch?v=Hd1uTUgDxKo&feature=youtu.be>

Recycle

https://www.youtube.com/watch?v=-jyKDGlaF_g&feature=youtu.be

KAB YOUTH ADVISORY COUNCIL

<https://www.kab.org/our-programs/education/youth-advisory-council>



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